



CERTIFICATE OF AUTHENTICITY

THIS IS TO CERTIFY THAT THE FOLLOWING ELECTRONIC RECORDS ARE TRUE AND ACCURATE REPRODUCTIONS OF THE ORIGINAL RECORDS OF JAMES CITY COUNTY GENERAL SERVICES DEPARTMENT- STORMWATER DIVISION; WERE SCANNED IN THE REGULAR COURSE OF BUSINESS PURSUANT TO GUIDELINES ESTABLISHED BY THE LIBRARY OF VIRGINIA AND ARCHIVES; AND HAVE BEEN VERIFIED IN THE CUSTODY OF THE INDIVIDUAL LISTED BELOW.

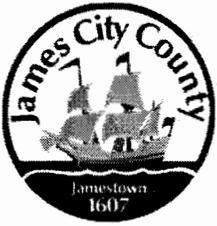
BMP NUMBER: PC115

DATE VERIFIED: November 5, 2012

QUALITY ASSURANCE TECHNICIAN: Leah Hardenbergh

Leah Hardenbergh

LOCATION: WILLIAMSBURG, VIRGINIA



Stormwater Division

MEMORANDUM

DATE: March 9, 2010
TO: Michael J. Gillis, Virginia Correctional Enterprises Document Management Services
FROM: Jo Anna Ripley, Stormwater
PO: 270712
RE: Files Approved for Scanning

General File ID or BMP ID: PC115

PIN: 3210100001D

Subdivision, Tract, Business or Owner

Name (if known):

Seasons Trace

Property Description:

Common Area

Site Address:

325 Seasons Trace

(For internal use only)

Box 6

Drawer: 3

Agreements: (in file as of scan date) N

Book or Doc#:

Page:

Comments
Wet Pond

16' width at top
of dam

Compact clay core and local material for dam in 2' lifts with sheepsfoot roller to 95% maximum density standard.

TOP OF BERM (DAM) = ELEV 82.0
 CREST OF EMERGENCY SPILLWAY = 80.0
 DESIGN HIGH WATER = 81.0 (100 yr Storm)
 TOP OF GATE PRINCIPAL SPILLWAY = 77.0
 NORMAL POOL ELEV = 77.0

VDHT STD. 24" RCP END SECTION (ES-1)

EROSION CONTROL STONE (EC-1 TYPE A AT outlet, 2 c.y.)

local material

Clay Core (obtained locally)

18" Gate Valve with extension stem and guides. Open once a month to maintain valve in operating order.

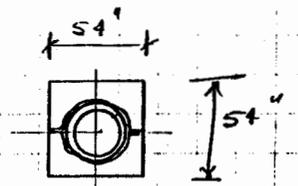
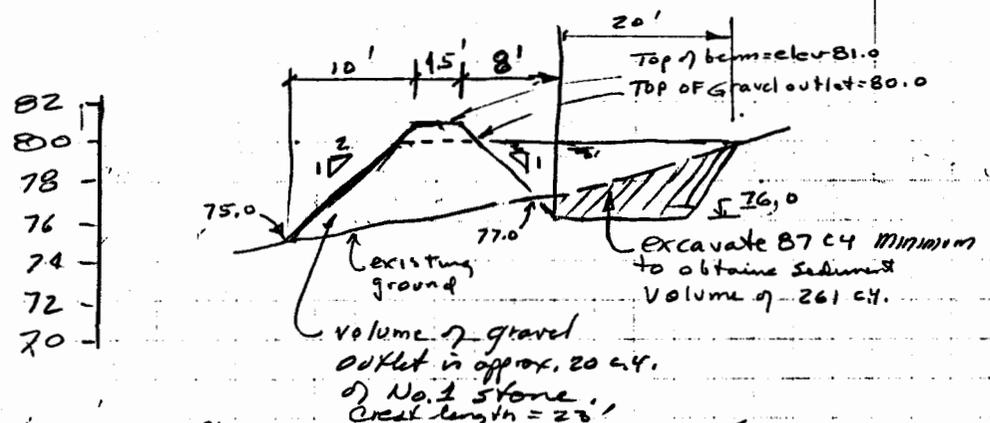
excavate to obtain req'd sediment vol. of 261 c.y.
 Precast Drop Inlet VDHT DI-1, 1A PC TOP 77.0 INV 61.0 H = 16' with DI-7, Type I grad and 18" x 8" diamet poured concrete base

100' of 24" RCP @ 1.0%
 28' of 18" RCP @ 14.5%

PC115

1+00 0+20 0+40 0+60 0+80 1+00

Cross Section of Permanent Sediment Basin at Principal Spillway
 (1" = 20' Horiz, 1" = 10' Vertical)



Anti-Seep Collars 4 req'd [see note 6 (U).]

PC115

Sed Pond

0.52

0.009
0.400

1+80 ES-1 DS-1
 +20
 2700 storm MH DS-2
 +96

DS-3 2+96 storm DI +158 4+54 DI DS-4
 +2+41

5+37 storm MH DS-5
 1+14

6+51 storm MH DS-6
 +101

7+52 DI DS-7
 +14

7+66 ES-1 DS-8

291
 158
 83

~~Storm Flow~~

Storm Flow Calculations (Runoff)

Location	Drainage Area (Ac)	Time of Concentration				Coeff. C	Rainfall (in/hr)	Storm Flow (cfs)
		L	ΔH	Savg	Tc			
DS-8 inlet & outlet	0.06	60	7	12%	10	.5	6.0	0.3
DS-7 outlet	0.91	235	22	9%	10	.5	6.0	2.73
DS-7 inlet	0.85	-	-	-	10	.5	6.0	2.33
DS-9 inlet	0.56	-	-	-	10	.5	6.0	1.63
DS-6 inlet	0.46	-	-	-	10	.5	6.0	1.33
DS-6 and DS-5 outlet	1.93	-	-	-	10	.5	6.0	5.77
DS-1 inlet	1.53	-	-	-	10	.5	6.0	4.59
DS-4 outlet	3.46	550	12	2%	10	.5	6.0	10.4
DS-3 inlet	0.10	-	-	-	10	.5	6.0	0.30
DS-3, 2 & 1	3.56	-	-	-	10	.5	6.0	10.7
DS-13 & 14	0.14	210	16	8%	10	.5	6.0	0.42
DS-15	1.71	550	19	3%	10	.5	6.0	5.13
DS-16	1.85	-	-	-	10	.5	6.0	5.55
DS-10, 11 & 2	17.03	1400	35	3%	18	.5	4.6	39.2

↑ Single space table for sketchy book

DRAINAGE CALCULATIONS

Stuckey Design Heights, Inc.
back $n = 0.013$
Hydraulic Score

1. CAPACITY OF DROP INLETS

Use std D1-grate, $A = 2.33 \text{ sf}$

allowable head = $3/8" / \text{FT} \times 10' = 3/8 \times 1/2 = 0.34'$

From Fig. 4.6.10.10, Grate capacity = 6.6 cfs

For DS-3, $Q_{10} = 0.30 < 6.6$, adequate

For DS-4, $Q_{10} = 4.59 < 6.6$, adequate

For DS-6, $Q_{10} = 1.38 < 6.6$, adequate

For DS-7, $Q_{10} = 2.73 < 6.6$, adequate

For DS-9, $Q_{10} = 1.68 < 6.6$, adequate

Manning's Formula

$$Q = 0.4632 \left(\frac{D^{8/3} S^{1/2}}{n} \right)$$

$$V = \frac{1.486}{n} \left(\frac{D}{4} \right)^{2/3} S^{1/2}$$

2. STORM SEWER CALCULATIONS (n = 0.013)

Location	Q_{10} (cfs)	SIZE (inches)	Slope (FT/FT)	Q_F (cfs)	V_F (FPS)	Adequate?	Pipe length	Pipe Inlet	Pipe Outlet
DS-8 to DS-7	0.18	12"	0.0578	8.57	10.9	yes	14'	97.26	0
DS-7 to DS-6	2.73	12"	0.1179	12.23	15.6	yes	101'	96.35	3
DS-9 to DS-6	1.68	12"	.011	3.73	4.5	yes	94	85.50	3
DS-6 to DS-5	5.79	15"	.010	6.46	5.3	yes	114	81.17	3
DS-5 to DS-4	5.79	15"	.010	6.46	5.3	yes	83	82.93	3
DS-4 to DS-3	10.4	18"	.010	10.42	5.9	yes	158	81.85	3
DS-3 to DS-2	10.7	18"	.026	16.93	9.6	yes	96	80.17	7
DS-2 to DS-1	10.7	18"	.026	16.93	9.6	yes	20	77.52	7

3. CULVERT CALCULATIONS

Culvert NO	Location	Q_{10} (cfs)	DIA (inches)	length ft	Slope %	Inverts		Inlet Control		Outlet Control			allow HW		
						In	out	HW/D	HW	H	Ho	L50		HW	
1	DS-13 to DS-14	0.42	15"	68'	6.1	97.34	101.50	adequate by inspection			1.25	0			
2	DS-15 to DS-16	5.13	15"	80'	2.5	96.6	94.6	1.1	1.38	.8	1.25	2.0	0.05	1.50	8
-	DS-3 to DS-7	0.18	12"	14'	5.78	97.26	92.45	adequate by inspection			1.0				

a) EC-1, type A erosion control stone provided at outlet of Culvert No 2

b) Paved ditches may be required where slopes exceed 2 to 3% if a firm stand of grass cannot prevent erosion of side ditches. This will be decided upon field inspection by VDH&T prior to acceptance of roadways into system.

Side Ditch Calculations

Ditch Location Road	Point	D.A. (%)	C	Tc (min)	Iz in/hr	Qz (cfs)	Slope (ft/ft)	Vz fps	Lining Type	Allow. Vel	Iz in/hr	Q10 (cfs)	D: (in)
Summer West	0+25, L&R	0.16	0.5	10	4.6	0.37	0.70	2.2	grass	5.0	6.0	0.48	4
Seasons Trace Rd	10+30, L&R	1.55	0.5	10	4.6	3.57	.025	2.6	grass	5.0	6.0	4.66	1
"	9+50 L	1.95	0.5	10	4.6	4.37	.025	2.7	grass	5.0	6.0	5.70	1
"	7+80 L	2.25	0.5	10	4.6	5.18	.029	2.9	grass	5.0	6.0	6.75	1
"	7+80 R	0.54	0.5	10	4.6	1.24	.029	2.0	grass	5.0	6.0	1.61	7

Notes

a) All side ditches to be 15" minimum depth

b) Ditches to be lined with K-31 tall fescue, permissible velocity = 5.0 fps, $n = 0.05$

5. Stormwater Management Plan

a) The developer plans to install a permanent sediment basin at the location shown on the drawings. The majority of all runs - from the proposed development ^{will be directed} to this pond by internal storm sewers.

b) The storm flow prior to development and after development is estimated as follows:

	C	A	I ₂	I ₁₀	I ₁₀₀	Q ₂	Q ₁₀	Q ₁₀₀
prior to development	0.25	17.03	3.5	4.6	6.6	14.9	19.6	28.1
after development	0.5	17.03	3.5	4.6	6.6	37.8	39.2	56.2
difference						14.9	19.6	28.1

(an increase of 100% is expected to occur upon development.)

c) The permanent sediment basin will be owned and maintained by the Developer or his assignee (most likely the Seawaco Tract Homeowners Association).

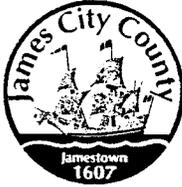
6. Design of Permanent Sediment Basin

- Use the procedure in SEC handbook for design of a temporary Sediment Basin.
- Provide standard DI-1 precast drop inlet with drain valve as the principal spillway. Grate will act as a train rack.
- Set principal spillway crest at elev. 77.0 (normal pool elevation)
- Excavate lake at shallow end to a depth of 7' to prevent growth of weeds and allow for required sediment storage.
- Volume of Basin = $0.4 \times A \times D = 0.4 \times 40400 \times 17' = 274,720 \text{ cf} = 10,175 \text{ cu yd}$.
- Required sediment volume = $67 \text{ cu yd/acre} \times 17.03 \text{ Ac} = 1141 \text{ cu yd}$, or 11% of the Pond volume.
- Length to width ratio is approximately $1\frac{1}{2} : 1$
- Provide an emergency earth spillway in the west abutment of the dam.
- The downed spillway must pass at least $0.2 \text{ cfs/ft} \times 17.03 \text{ Ac} = 3.41 \text{ cfs}$
- It is desirable to exceed this and design the principal spillway to pass the ten year storm flow of 39.2 cfs.
- A DI-7, type I grate with 6 sf of open area will pass 39.2 cfs with two feet of water over the grate. (Fig. 4.6.10.10 VDOT Drainage)
- A 24" concrete pipe on a slope of 0.040 has a capacity of 45.3 cfs which is sufficient to pass the 10 year storm flow of 39.2 cfs.
- Set the emergency spillway crest at elevation 80.0 (1 foot above the 10 year flood level). This will provide an additional volume of storage above the principal spillway to buffer the downstream effects of a storm larger than the 10 year storm. It will also provide a safety factor for closing of the grate.
- The difference between the 10 year and 100 year storm ($56.2 - 39.2 = 17 \text{ cfs}$) should be the capacity of the emergency spillway.
- A 12' bottom width with an exit slope of 3:3% having an exit channel length of 44', will pass 19 cfs at a velocity of 3.5 fps with only 0.8' of head over the crest. Design high water = elev 80.80.
- Set top of berm (dam) 1.2' above high water or at elevation 82. This allows for freeboard, settlement, construction tolerance and prevents topping of the dam during the 100 year storm event.
- The pond drain will be sized to pass the 10 year storm in 4 hours. The pond is drained and the principal spillway at

- as a culvert. The 18" concrete pipe on a slope of 14.5% has a capacity of 40 cfs which is adequate for this purpose.
- (j) The exit velocity in the principal spillway during the 10 year storm assuming full pipe flow is 14 fps. This will require installation of dumped erosion control stone (VDOT std. EC-1, type A) at the ~~exit~~ to dissipate the energy and control erosion at the outlet.
- (k) Since the emergency spillway is designed to operate on a 10 year frequency basis, it is felt unnecessary to line the wooded area below the exit channel.
- (l) The dam is to be constructed with a clay core and local material compacted in not less than 2' layers to 95% density standard.
- (m) Fourth, anti-seep collars projecting 1' around the pipe barrel are to be installed on 24' centers to increase seepage length by 10%. Collars may be poured concrete 6" in thickness formed around the pipe with #4 rebar on 12" centers horizontally and vertically, or 1/8" galvanized sheet metal (lapped & bolted) grouted to pipe barrel between joints. The overall dimensions of the collar are 54" x 54"

7. Sediment and Erosion Control Measures

- a) See typical notes on standard detail sheet.
- b) Provide diversion ditches at locations shown to direct flows to facilitate
- c) Provide temporary sediment trap in ravine behind lots 15 & 16.
 Drainage area = 3.9 Ac, sed. vol. = $67 \times 3.9 = 261$ c.y., length of
 crest = $6 \times 3.9 = 23'$, $H_0 = 4'$, $H = 5'$, $W = 4.5'$, Top = elev 81.9
 crest = elev 80.0, Natural Volume = $0.4 \times 2940 \times 4' = 4704$ cf = 174 c.y.
 Excavate 87 c.y. to obtain req'd sediment volume. provide 2:1
 side slopes and stabilize with ryegrass. Approx. vol. of No 1
 stone for gravel outlet is 20 c.y. (two 10 c.y. loads).
 Excavation should be more than enough for earthen embankment
 on each side of gravel outlet. Remove trap after site work is
 complete and all disturbed areas are stabilized.
 Provide diversion ditch around sediment trap to intercept
 and channelize natural ravine flow around trap.
- d) Provide straw bale drop inlet filters at DS-9, DS-7, DS-4,
 DS-3 and at exist. drop inlets on Seasons Trace Road.
- e) Provide straw bale check dams at 100' intervals along
 both sides of Seasons Trace Road and Summer West.



DEVELOPMENT MANAGEMENT

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 (757) 253-6626
 codecomp@james-city.va.us

ENVIRONMENTAL DIVISION
 (757) 253-6670
 environ@james-city.va.us

PLANNING
 (757) 253-6685
 planning@james-city.va.us

COUNTY ENGINEER
 (757) 253-6678
 INTEGRATED PEST MANAGEMENT
 (757) 253-2620

July 12, 2000

Ms. Sue Dugger
 Seasons Trace HOA
 709 Autumn Trace
 Williamsburg, Va. 23188

Re: Seasons Trace
 SR 612 Longhill Road
 Ponds 1, 2 and 3

Dear Ms. Dugger:

At your request, the Environmental Division is forwarding information relative to a meeting and general inspection held on Thursday June 8th 2000 for the above referenced wet pond facilities. The wet ponds included Pond 1 (Spring East), Pond 2 (Spring West) and Pond 3 (Season Trace North). In addition to specific comments as outlined below, the following additional information is also attached for your group's review and use:

- A 1 inch = 500 ft. scale map showing the General Location of Ponds 1, 2 and 3.
- A previous Inspection Report performed for Pond 3 dated January 27th 1998.
- A current Inspection Report performed for Pond 3 dated June 8th 2000.
- A Typical Maintenance Plan for Pond 3.
- General Landscaping Guidance (Tips). Applicable to all the ponds.
- Two (2) Informative Brochures published by the Association of State Dam Safety Officials - *Dam Ownership: Responsibility and Liability* and *Dam Ownership: Procuring the Services of a Professional Engineer*.

Please note that very little design or as-built (record) drawing information was found in our files for the facilities. Since there were no visible signs of a multi-stage riser structure for Ponds 1 and 2, it was difficult to assess (without further detailed investigation) the extent of stormwater quality or quantity control provided by these wet ponds.

Since Pond 3 is a structure with a large engineered embankment (fill) and a considerable normal pool area, a general Maintenance Plan was provided for this facility as a courtesy. The plan was prepared based on our general knowledge of maintenance required for these types of facilities. It is provided for information and guidance purposes when no other specifically approved maintenance plans are available for use. The plan is not meant to replace or supersede any specific recommendation offered by a qualified professional. The plan only addresses normal structural, stormwater runoff control and aesthetic activities related to safe function of the facility. Landscaping, cosmetic or ornamental features associated with facilities are usually left to the discretion of the owner, or its designated representative, unless these features deter from the structural integrity or the performance of water quality or quantity controls provided for the facility.

Specific Comments about the Facilities

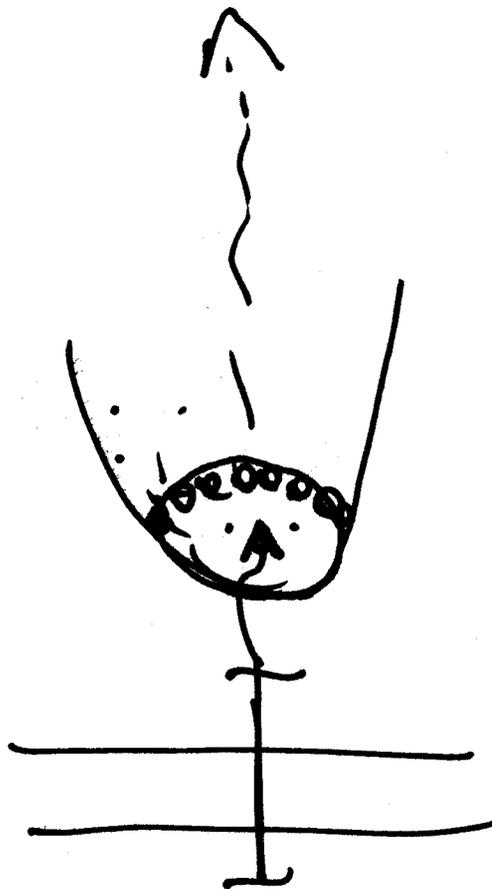
Pond 1 (Spring East)

Although surface algae was present in trace amounts along the water's edge, the main concern for Pond 1 from our perspective was erosion of the shoreline fringe. This is the area of contact between the normal water surface (pool) of the pond and the soil slope. Shoreline erosion can be due to fluctuations in the pool level or wave action. A shallow water shelf exists on the outer fringe of the normal pool. Erosion of the soil slopes and subsequent sedimentation onto the shallow shelf may be a contributory factor in the presence of surface algae along the water's edge. Incorporation of native shallow water wetland-type plants along the shallow water shelf (0 to 1 foot deep areas) and shoreline fringe (0 to 2 feet above the average pool level) may help this condition. Some suggested plant species may include arrow arum, arrowhead, broomsedge, common three square, pickerelweed, sedges and soft-stem bulrush. Any local landscaper or nursery can be consulted for selection of wetland-type plants that are adaptable to the pond's specific soil, water, sun-shade and temperature conditions as well as positive or negative characteristics due to uses by wildlife. Other bare soil or eroded areas around the facility should be overseeded and mulched to allow vegetation to establish and reduce sedimentation to the pond.

Although cleaning of sediment from the bottom of the pond does not appear immediately necessary, it may be necessary sometime in the near future. Bottom sediments may be a contributory factor in the presence of surface algae and thicker vegetation in bottom of the pond. Chemical treatment, as currently being performed, should continue to help this condition on an interim basis. Leaves falling into the water from perimeter trees have introduced an moderate amount of organic material. Efforts should be continued to clean or prevent leaves from perimeter trees (organics) from falling into the water pool. Continued efforts should be performed to eliminate or reduce fertilizers and grass clippings from lots, and more importantly, common areas mowed adjacent to the pond. These materials directly find their way into the stormwater drain system and water pool. These materials add nutrients to the stormwater and sediments, which in turn may stimulate excessive growth of vegetation and aggravate the algae bloom condition at the pond. Aeration is also a positive option for the pond to minimize algae formation.

Pond 2 (Spring West)

Although surface algae was present in slight to moderate amounts along the water's edge, the main concern from our perspective was again erosion of the shoreline fringe and the presence of grass clippings from adjacent common area mowing being directed toward the water's surface. The small fish and frog population in the pond appeared healthy and in satisfactory condition. All recommendations presented above for Pond 1 also apply to Pond 2.



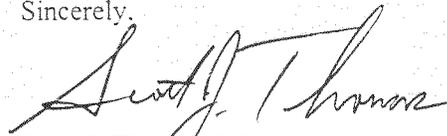
Pond 3 (Seasons Trace North)

Based on field observations, the main concerns for Pond 3 from our perspective was the presence of tree vegetation on and along the toe of the engineered fill embankment, shoreline erosion and maintenance needed at the two primary storm drain inflow locations. The pond's embankment is west of the water pool where the riser pipe is located. Several smaller trees were present along the upstream toe and heavy tree and ground vegetation covered most of the downstream embankment and lower portions of the emergency spillway. These trees should be removed. We recommend that the trees be cut to ground level and be maintained in that fashion as to not disturb root systems that may already be extensive. Efforts should be made to establish a good low-maintenance grass covering to replace the current tree covering. Vegetation and tree growth in other areas surrounding the normal water pool may be removed or left in place at the preference of the owner, depending on whether a dressed or natural look is preferred. Bare soil or eroded areas around the facility should be overseeded and mulched to allow vegetation to establish and reduce sedimentation to the pond. Recommendations to minimize shoreline erosion as presented above for Ponds 1 and 2 also apply to Pond 3.

The pond's two primary storm drain inflows, located along the north side of the water pool and near Season Trace (road) at the east side of the pool, are in need of immediate attention. At the north inflow the pipe end section needs repair, outlet riprap needs replaced and cleaning and removal of accumulated sediment is necessary. At the east inflow, the last inlet along the road needs cleaning, the adjacent roadway side slope needs seeding and mulching and sediment, which has accumulated just downstream of the pipe outfall, needs removed. It is highly suggested that a pretreatment sediment forebay be created at this location to force sediment to deposit at a easily accessible location for future cleanout purposes. *(Note: If pursued, review and approval of sediment forebay plans and details at this location may be necessary by the County and VDOT).* Although cleaning of sediment from the bottom of Pond 3 does not appear immediately necessary, it may be necessary sometime in the near future.

Hopefully, this material is helpful to your group to understand maintenance associated with the onsite wet ponds. Please review the information and contact us at 757-253-6639 or 757-253-6673, if you have any further questions or comments.

Sincerely,



Scott J. Thomas, P.E.
Civil Engineer
Environmental Division

Enclosures

G:/SWMPProg/Edu/Subdiv/SeasonsTr..lett



COMMONWEALTH of VIRGINIA

George Allen
Governor

Department of Game and Inland Fisheries

Becky Norton Dunlop
Secretary of Natural Resources

William L. Woodfin, Jr.
Director

03/28/97

Sue Dugger
709 Autumn Trace
Seasons Trace
Williamsburg

Dear Sue

The main problem with the ponds is filamentous algae. For the purpose of control it is not usually necessary to identify which type it is because the right herbicide will be effective for virtually all of them. It seems that you also have macroalgae (possibly Chara, the larger more defined strands of plant) and watermeal (the duckweed-like small green floating discs).

Big Pond C - all filamentous algae

Medium Pond D - mainly filamentous algae with Chara

Smallest Pond - Chara and watermeal

Copper sulfate is excellent for algae, but is poor on watermeal and fish are sensitive to it. Special care has to be taken when applying this herbicide because of the dangers to fish - see attached note. This herbicide can be applied without certification and can be purchased from farm/garden supply stores.

Diquat is excellent for filamentous algae, good for Chara, and poor-fair for watermeal. Note that Diquat will also control many other plant species that may be present. It kills quickly and so should be applied as partial treatments and not the whole pond at once. This reduces the chance of low dissolved oxygen levels (harmful to fish) which can occur as the dead algae decomposes. Note: the water cannot be used for human or animal consumption, crop irrigation, agricultural spray for 14 days; no turf irrigation for 5 days. Only a certified applicator can use this herbicide. A list of applicators can be obtained from the Extension Service (government listings in phone directory). They can work out the required concentration for the size of the ponds (the attached sheet provides some guidance).

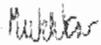
An Agency of the Natural Resources Secretariat
5806 MOORETOWN ROAD, WILLIAMSBURG, VA 23188
(804) 253-7072 Equal Opportunity Employment, Programs and Facilities FAX (804) 253-4182

The best time to apply the herbicide is the spring (March, April, May). Always check the label to ensure it is safe for fish (the applicator should know this already) . If possible it may be handy to have an aerator (or just a submersible pump with the outlet pipe angled up so that water has to fall back into the pond with a splash thus allowing oxygen back into the water) in case oxygen depletion occurs. After the herbicide is applied keep an eye on the fish for a week. If they appear near the surface, lack energy, and gulp air - use your pump or aerator.

Unless you are pretty confident about using copper sulfate it might be advisable to go for the licensed applicator and Diquat (or an equivalent formulation).

I hope you find this useful (and that you have not already tried these herbicides since you have not had any success so far, maybe the dose was not appropriate). Give me a call if you need to discuss further. If you have success with this the next step to consider is grass carp.

Yours sincerely



Mukhtar Farooqi



James City County Environmental Division
 BMP Inspection Report
 Detention and Retention Pond Facilities

Name of Facility: Seasons Trace North Pond BMP No.: 3 Date: June 8, 2000
 Location: Seasons : Autumn Trace (North section of Development)
 Name of Owner: HOA
 Inspector: Scott J. Thomas, P.E. James City County Environmental Division
 Type of Facility: Wet Retention Pond
 Weather Conditions: Sunny, Mid 80's

If an inspection item is not applicable, mark N.A. otherwise mark the appropriate column.

- O.K. - The item checked is in adequate condition and the maintenance program is currently satisfactory.
- Routine - The item checked requires attention, but does not present an immediate threat to the function of the BMP.
- Urgent - The item checked requires immediate attention to keep the BMP operational and prevent damage to the facility.

Provide an explanation and details in the comment column, if routine or urgent are marked.

Facility Item	O.K.	Routine	Urgent	Comments
Embankments and Side Slopes:	<i>Located West side of Permanent Pool</i>			
Grass Height	✓			
Vegetation Condition		✓		<i>Bare spots Need Reseeded.</i>
Erosion	✓			
Weed Growth		✓	✓	<i>Downstream Embankment Trees.</i>
Trash and Debris	✓			
Lining	✓			<i>No structural slope lining.</i>
Safety Fencing	N/A			
Constructed Wetlands:	N/A			
Vegetation Condition	N/A			
Trash and Debris	N/A			
Floatables	N/A			
Erosion	N/A			
Sediment	N/A			
Dead Plant Removal	N/A			
Aesthetics	N/A			
Other	N/A			

Facility Item	O.K.	Routine	Urgent	Comments
<input checked="" type="checkbox"/> Permanent Pools (Retention Basins) or <input type="checkbox"/> Shallow Marsh (Detention Basins):				
Shoreline Erosion		✓		Moderate shoreline erosion due to pool fluctuations & wave action.
Algae	✓			Appears Acceptable.
Trash and Debris	✓			
Sediment		✓		North & East storm drain inflows.
Aesthetics	✓			
Other	✓			
Inlet Structure # 1 (Describe Location): <i>North Side of Permanent Pool.</i>				
Condition of Structure		✓	✓	Moderately damaged flared end section. Failed pipe joints.
Erosion		✓	✓	NEEDS Riprap Outlet Protection.
Trash and Debris	✓			
Sediment		✓	✓	Sediment Removal Necessary.
Aesthetics		✓		General Vicinity Trees & Weeds.
Other				
Inlet Structure # 2 (Describe Location): <i>East of Permanent Pool along Season Trace (Road)</i>				
Condition of Structure		✓		Flared end section undermined.
Erosion		✓	✓	Riprap Outlet Protection Needed.
Trash and Debris	✓			
Sediment		✓		Moderate depth of Sediment.
Aesthetics		✓		Construction of Sediment Forebay suggested.
Other	✓			
Inlet Structure # 3 (Describe Location): <i>No other Primary Locations Observed.</i>				
Condition of Structure	N/A			
Erosion	N/A			
Trash and Debris	N/A			
Sediment	N/A			
Aesthetics	N/A			
Other	N/A			
Outlet - Principal Flow Control Structure (Describe Location):				
Condition of Structure	✓			Appears Acceptable from Shoreline.
Erosion		✓		Outlet Protection Riprap Needed.
Trash and Debris	✓			
Sediment	✓			
Aesthetics	✓			Discoloration.
Other	✓			Water Level Not to Top Riser.

Facility Item	O.K.	Routine	Urgent	Comments
Emergency Spillway (Overflow):				
Vegetation		✓	✓	Removal of trees, brush and wooded debris piles Required.
Lining	✓			Grassed.
Erosion	✓			None Observed.
Trash and Debris	✓			" "
Dam Condition		✓		Previous inspection Report Seepage Condition not observed this time.
Other	✓			
Nuisance Type Conditions:				
Mosquito Breeding		✓		Routine Spray Program.
Animal Burrows	✓			
Graffiti	✓			
Other		✓		Waterfowl maybe contributory to shoreline erosion.
Perimeter Conditions:				
Grass Height	✓			
Vegetation Condition	✓			
Trash and Debris	✓			
Aesthetics	✓			
Other	N/A			
Remarks:				
<ul style="list-style-type: none"> • Downstream Embankment Requires Immediate Tree Removal. High Safety Hazard. • Moderate shoreline erosion. Suggest implementation of shoreline & shallow water wetland type plants. • North side storm drain inflow needs immediate maintenance. • East side storm drain inflow needs sediment removed and maintenance. Suggest construction of sediment forebay to improve future maintenance. • Removal of brush, trees and wooded debris piles from emergency spillway required immediately. • Continue monitoring large seepage spot observed in last inspection report on right side of abutment (flow 1/4-1/2 gpm). Seepage was not observed during this inspection. 				
Signature: <u>Awitz Thomas P.E.</u>		Date: <u>06/08/2000</u>		
Title: <u>JCC Environmental Division</u>				
<u>Civil Engineer</u>				



**JAMES CITY COUNTY
ENVIRONMENTAL DIVISION
BMP INSPECTION CHECKLIST
WET POND**

Name of Facility: Season's TRACE - SECTION 7? BMP No.: _____ Date: 1/27/98

Location: off Seasons Trace Road

Name of Owner: Season's TRACE HOA

Inspector: _____

Type of Facility: WET POND

Weather Conditions: Overcast - 40°

If an inspection item is not applicable, mark NA, otherwise mark the appropriate column.

O.K. - the item checked is in good condition and the maintenance program is adequate.

Routine - The item checked requires attention, but does not present an immediate threat to the BMP function.

Urgent - The item checked requires immediate attention to keep the BMP operational and prevent damage to the facility.

Provide an explanation and details in the comment column if routine or urgent are marked.

FACILITY ITEM	O.K.	ROUTINE	URGENT	COMMENTS
EMBANKMENTS AND SIDE SLOPES:				
Grass Height	✓			
Vegetation Condition		✓		Needs overseeding + fertilizer
Erosion	✓			
Weed Growth			✓	Downstream Face needs tree removal
Trash and Debris	✓			
Lining	NA			
Safety Fencing	NA			
CONSTRUCTED WETLANDS:				
Vegetation Condition	NA			
Trash and Debris				
Floatables				
Erosion				
Sediment				
Dead Plant Removal				
Aesthetics				
Other				
PERMANENT POOLS IN RETENTION BASINS:				
Shoreline Erosion		✓		Provide RR in limited locations
Algae		✓		Needs treatment
Trash and Debris	✓			
Sediment		✓		near pipe out falls into lake
Aesthetics	✓			

FACILITY ITEM	O.K.	ROUTINE	URGENT	COMMENTS
Other	NA			
INLET STRUCTURE (DESCRIBE LOCATION): left side of dam looking upstream				
Condition of Structure				Partially broken flared end section
Erosion			✓	Needs riprap & fill to correct undermining
Trash and Debris	✓			
Sediment		✓		Some removal needed
Aesthetics		✓		Needs vegetation, reshaping
Other				
INLET STRUCTURE (DESCRIBE LOCATION): @ inlet end of dam near Seasons Trace Rd.				
Condition of Structure	✓			Flared end section not level - flared end undermined
Erosion		✓		Needs more R.R.
Trash and Debris	✓			
Sediment		✓		Build up in lake @ upper end
Aesthetics		✓		
Other				Riprap around the flared end section
INLET STRUCTURE (DESCRIBE LOCATION): - Sediment entering from inlet structures @ road				
Condition of Structure				
Erosion				
Trash and Debris				
Sediment				
Aesthetics				
Other				
OUTLET STRUCTURE (DESCRIBE LOCATION):				
Condition of Structure	✓			OK - what can be seen
Erosion		✓		Needs more Riprap
Trash and Debris		✓		minor amount of debris
Sediment				
Aesthetics	✓			Discharge rust-colored
Other				Water level not @ top of riser
EMERGENCY SPILLWAY AND DAM:				
Vegetation			✓	Remove trees from downstr. face
Lining	NA			- Needs vegetation (grass) in ES.
Erosion	✓			
Trash and Debris	✓			
Dam Condition		✓		See comments on seepage
Other				

FACILITY ITEM	O.K.	ROUTINE	URGENT	COMMENTS
NUISANCE CONDITIONS AT THE FACILITY:				
Mosquito Breeding		✓		
Animal Burrows	✓			
Graffiti	✓			
Other		✓		Water fowl may be causing erosion to shore line
PERIMETER CONDITIONS AT THE FACILITY:				
Grass Height	✓			
Vegetation Condition	✓			
Trash and Debris	✓			
Aesthetics	✓			
Other				

REMARKS:

Large seepage flow on right abutment - looking downstream - need to watch
 - flow $\approx \frac{1}{4} - \frac{1}{2}$ gpm

Date Record Created:

WS_BMPNO:

Print Record

Created By:

PC115

PRINTED ON
Tuesday, March 09, 2010
10:25:15 AM

WATERSHED PC
 BMP ID NO 115
 PLAN NO Unknown
 TAX PARCEL (32-1)(1-1D)
 PIN NO 3210100001D
 CONSTRUCTION DATE
 PROJECT NAME Seasons Trace Wet Pond # 3
 FACILITY LOCATION Seasons Trace North (Autumn Trace)
 CITY-STATE Williamsburg Va
 CURRENT OWNER Season Trace HOA
 OWNER ADDRESS 161 B John Jefferson Sq.
 OWNER ADDRESS 2
 CITY-STATE-ZIP CODE Williamsburg, Va. 23185
 OWNER PHONE
 MAINT AGREEMENT Yes
 EMERG ACTION PLAN No

MAINTENANCE PLAN No
 SITE AREA acre
 LAND USE SF Residential
 old BMP TYP Wet Pond
 JCC BMP CODE A2 Wet Pond
 POINT VALUE

SVC DRAIN AREA acres 15

SERVICE AREA DESCRI SF Residential & Roadway

IMPERV AREA acres
RECV STREAM Longhill Swamp

EXT DET-WQ-CTRL No
WTR QUAL VOL acre-ft 0

CHAN PROT CTRL No
CHAN PROT VOL acre-ft 0

SW/FLOOD CONTROL Yes
GEOTECH REPORT No

CTRL STRUC DESC
 CTRL STRUC SIZE inches
 OTLT BARRL DESC
 OTLT BARRL SIZE inch

EMERG SPILLWAY Yes
 DESIGN HW ELEV
 PERM POOL ELEV
 2-YR OUTFLOW cfs
 10-YR OUTFLOW cfs
 REC DRAWING No

CONSTR CERTIF No

LAST INSP DATE 6/8/2000 Inspected by:

INTERNAL RATING 2

MISC/COMMENTS
No plans or H&H. Letter to HOA dated 07/12/2000. Larger BMP. See PC 116 & 117.

Get Last BMP No

Return to Menu

Additional Comments:



SEASONS TRACE POND # 3 MAINTENANCE PLAN

(Note: This is a Typical Maintenance Plan for a Detention or Retention Pond facility. For general use by HOA's, or other designated parties which are responsible for operation, maintenance and inspection of BMP facilities when no other specifically approved plans are available. This is provided as a courtesy by the Environmental Division of James City County for informational purposes only. This plan addresses normal structural and stormwater runoff control aspects of the facility. It does not address landscaping, cosmetic, or ornamental features associated with the facility nor does it replace any specific recommendations offered by a registered professional.)

Maintenance Plan (Detention or Retention Pond BMP's)

A maintenance program is required to ensure the Stormwater Management (SWM) / Best Management Practice (BMP) pond facility functions as designed and to provide for reasonable aesthetic conditions. Proper maintenance is encouraged to prevent the introduction of debris and sediment into pretreatment areas (if applicable), the SWM/BMP itself, its principal inflow and outflow control structures and downstream waterways. Following facility installation, acceptance and establishment of vegetation in disturbed areas, inspections for sediment buildups should be performed at least quarterly. It is anticipated that under normal conditions, sediment removal will be required once every 5 to 10 years. If other construction or related land-disturbing activities are performed upland of the facility, adequate protection measures should be implemented and inspection frequencies increased to at least once weekly.

The designated party will inspect the SWM/BMP structure after each significant rainfall event or the following working day if a weekend or holiday occurs. A significant rainfall for this structure is defined as one (1) inch or more of gauged rainfall within a 24 hour period. Once per year (more or less) a representative of the County may jointly inspect the structure. Appropriate action will be taken to ensure appropriate maintenance. Where structures are to be maintained jointly, allocation of maintenance costs will be in accordance with terms established in maintenance agreements. Keys to locked access points or structures shall be made available to the County upon request.

Inspection and Maintenance of the Facility should consist of the following Additional Measures:

1. Inspect for sediment buildup by visual observation and a physical determination of sediment depth within pond's storage area. If sediment has accumulated significantly within the pond bottom, removal is required. At the same time, or at least once per year, clean pretreatment devices, the riser bottom and outlet pipes of accumulated sediments. Dispose of sediments removed from the facility at an acceptable disposal area. (Note: Typically the cleanout elevation is 10 to 25 percent of the design Water Quality Volume.)
2. Perform maintenance mowing of pond grasses at least twice each year. Grasses such as tall fescue should be mowed in early summer after emergence of the heads on cool season grasses and in late fall to prevent seeds of annual weeds from maturing. Mowing of legumes can be less frequent. Trees, shrubs and woody vegetation are not be permitted to grow on any part of pond embankment that was constructed using engineered (compacted) fills.
3. Perform soil sampling on stabilized pond soil areas at least once every 4 years. Soil sampling and testing should be performed a qualified independent soil testing laboratory such as VPI&SU. Apply additional lime and fertilizer in accordance with test recommendations.

4. In stabilized pond areas, if vegetation covers less than 40 % of soil surfaces, lime, fertilize and seed in accordance with recommendations for new seedlings. If vegetation covers more than 40 % but less than 70 % of soil surfaces, lime, fertilize and over seed in accordance with current seeding recommendations of the Virginia Erosion and Sediment Control Handbook (VESCH).
5. Perform quarterly inspections of the riser section and crest spillway for the observance of collected trash and debris. Immediately remove any trash or debris that prevents the movement of water. Remove any trash and litter downstream and at storm drain or channel inflow locations to maintain the integrity of the structure and provide an attractive appearance.
6. Perform yearly structural inspections of the facility for damage. Structural inspection shall be performed on the concrete riser, anti-vortex and trash rack cap, trash rack, orifices/weirs, outlet barrel and pond embankment. Exposed metal surfaces shall be painted to minimize rust damage or replaced if rust damage is irreversible. If damage is evident, further investigation by a registered professional engineer may be required to assess the integrity of the structure.
7. Perform quarterly inspections of graded side slopes of the facility for signs of animal/rodent borrows or slope erosion. Immediately perform necessary repairs, refilling or reseeded.
8. Perform yearly observations of perimeter areas surrounding the facility to ensure changes in land use, topography or access have not occurred and do not affect the operation, maintenance, access or safety features as provided for the facility. Appropriate action is required to ensure adequacy and to provide a clear, safe passage for maintenance vehicles to the embankment and principal flow control structures.
9. Inspect and exercise pond drain valves, if provided, on a regular basis.
10. Record Keeping. Keep reasonable, accurate written records of inspections and maintenance activities performed for the facility at all times. Records shall document routine maintenance and/or repairs performed. Copies shall be provided to the County upon request.
11. The facility shall not accept additional drainage or be modified in any way without prior consent or approval by the Environmental Division of James City County.

(End)

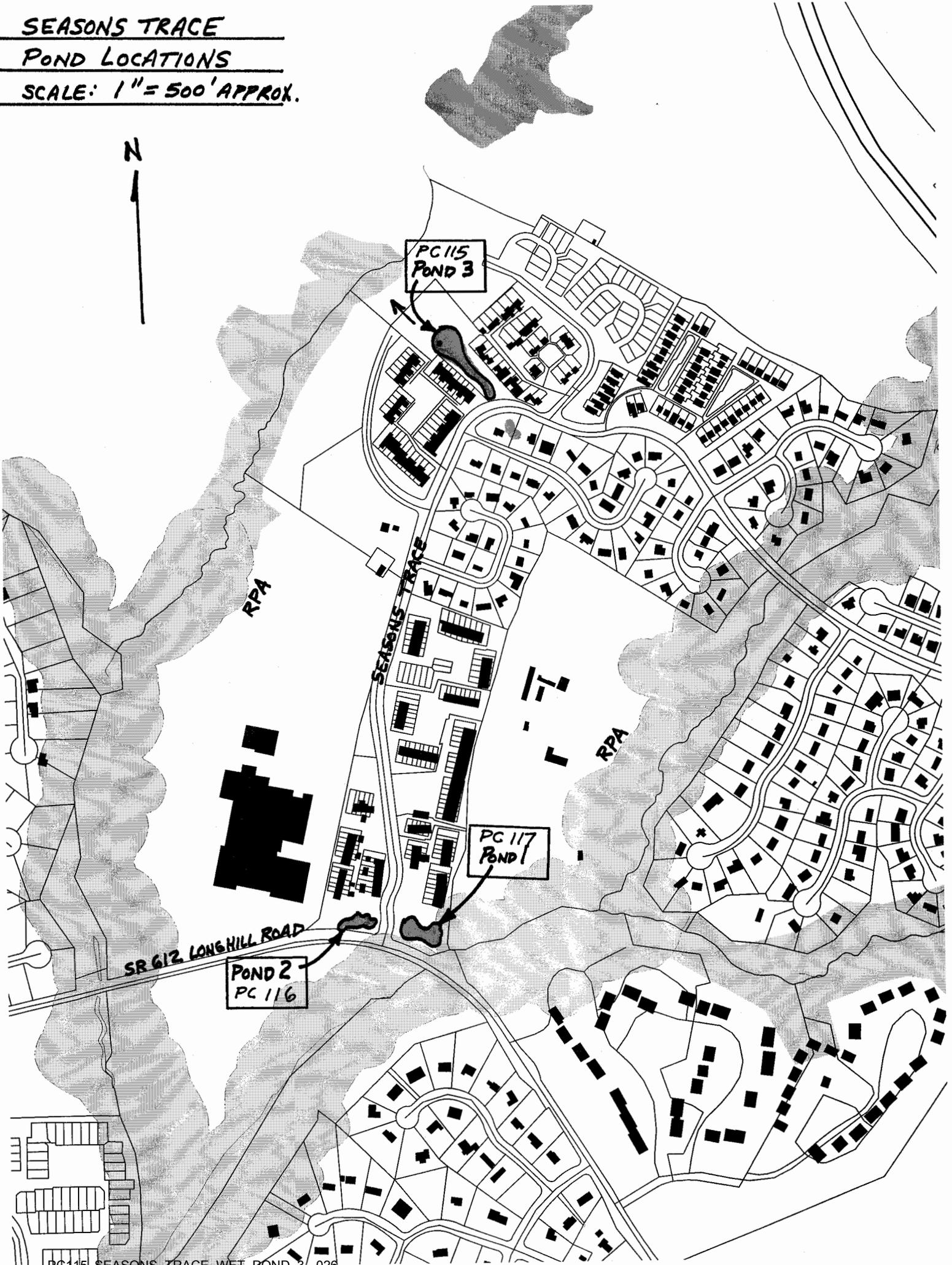
General Landscaping Guidance for All Stormwater Management BMP's

- Trees, shrubs and/or any type of woody vegetation are not allowed on the embankment.*
- Keep trees and shrubs at least 15 feet away from the toe of constructed fill slopes.*
- Keep trees or shrubs having long taproot systems away from earthen dams or subsurface drains.*
- Keep trees and shrubs at least 25 feet away from perforated pipes.*
- Keep trees and shrubs at least 25 feet away from principal flow control structures.*
- Keep vegetation at least 15 feet from low flow orifice openings.*
- Clean trash and debris as necessary from the facility and principal control structures. Only trained or authorized personnel should enter confined spaces or structural components of the facility.*
- Keep herbaceous (not woody) embankment plantings limited to ten (10) inches in height.*
- Maintain erosion control mats, blankets and fabrics in channels to reduce erosion potential.*
- Sod channels that are not stabilized with erosion control mats.*
- Keep emergency spillways stabilized with plant material that can withstand strong flows. Root material should be fibrous and substantial but lacking a taproot.*
- Seed and mulch bare, exposed or formed erosion gullies. Divert surface runoff from any reseeded and mulched areas until stabilized.*
- Check water tolerances of existing native plant materials prior to inundation of pond areas.*
- Stabilize aquatic and safety benches with emergent wetland plant species and wet-seed mixes.*
- Keep access to embankments or flow control structures free of trees or shrubs. Ensure areas that are planted adjacent to access routes can withstand compaction, damage or vibration that may occur due to passing vehicles or heavy equipment.*
- To reduce thermal warming effects, shade inflow and outflow channels as well as southern exposures to the greatest extent possible.*
- Avoid plantings that require routine or intensive chemical applications such as turf, etc.*
- Use salt tolerant plants if excessive amounts of deicing salt are anticipated in inflow runoff.*
- Soil test perimeter areas periodically to determine if soil amendments are necessary. Contact the local Virginia Cooperative Extension for assistance.*
- Use native plant species which adapt to local soil and weather conditions over exotic or foreign species.*
- Decrease or minimize areas where turf is used. Use low maintenance ground cover to absorb runoff where possible.*
- Plant stream and normal pool buffers with trees, shrubs, ornamental grasses and herbaceous material where possible to stabilize banks, provide shade and provide for water quality enhancement.*
- Use selective or strategic plantings to minimize access to deeper pools or steeper slopes.*
- If warranted, provide educational signs around the perimeter of the facility to indicate that it is a Stormwater Management Area or to designate planting, maintenance or mowing zones.*
- Avoid the overuse of any one type of plant material and material with weeds or invasive components.*
- Preserve existing, native vegetation to the greatest extent possible unless it deters from structural aspects of the facility.*
- Aesthetics and cosmetic characteristics should be a prime consideration. Strive to maintain a natural, scenic character for the BMP that blends well with the community theme, physical location and surrounding land uses and provides for screening, but yet maintains the structural aspects of the facility such as riser pipes, outlet barrels, spillways, trash racks, inlets, inflow channels, etc. Be certain original or enhanced landscaping does not encroach upon public or private roadways, sidewalks, trails or emergency vehicle access routes.*
- Refer to the approved design or construction plan for the BMP. Some approved plans provide site specific information related to operation, inspection and maintenance. Please note, however, this is a current requirement of the Environmental Division for stormwater management plans and this information may not necessarily be found on all plans, especially for older facilities. Contact the Environmental Division at 757-253-6670 for additional information.*

SEASONS TRACE

POND LOCATIONS

SCALE: 1" = 500' APPROX.



SEASONS TRACE

POND LOCATIONS

SCALE: 1" = 500' APPROX.



Fax

May 26 '00

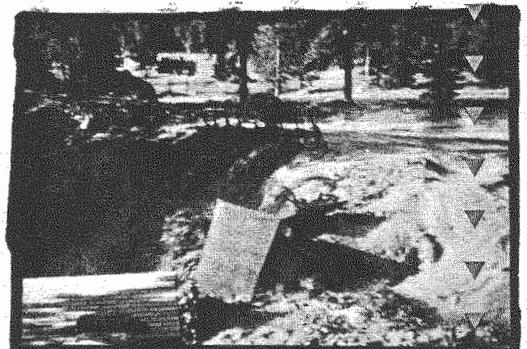
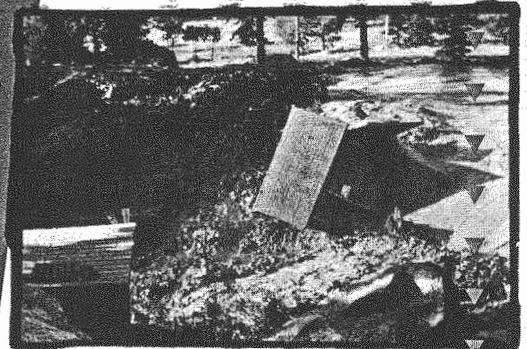
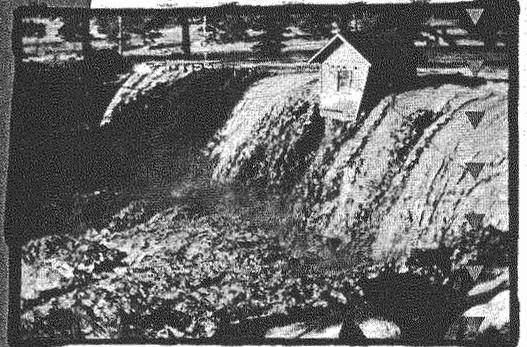
Page 1 of 5

To: Scott Thomas — 259-4032 (Fax)
JCC Environmental Dept.

From: Sue Dugger
709 Autumn Trace
Seasons Trace
Fax: 565-3326
Phone: 565-3030
Work: 220-9500

Directions:
GO INTO SEASONS TRACE
LEFT ONTO SPRING WEST
WILL ASSEMBLE @ PARKING AREA

DAM OWNERSHIP



ASSOCIATION OF STATE DAM SAFETY OFFICIALS

450 Old East Vine Street
Lexington, Kentucky 40507
Tel (606) 257-5140

RESPONSIBILITY AND LIABILITY

"Common law holds
that the storage of water is
a hazardous activity."

INTRODUCTION

Dams are owned and operated by individuals, private and public organizations, and the government. The responsibility for maintaining a safe dam rests with the owner.

A dam failure resulting in an uncontrolled release of the reservoir can have a devastating effect on persons and property downstream. ▲ Tens of thousands of public

and private dam owners in the United States have exposure to liability for the water stored behind their dams. ▲ For

many owners, the proper operation and maintenance of a dam is only one aspect of their organization's activities. But, safely maintaining a dam

is a key element in preventing a failure and limiting the liability

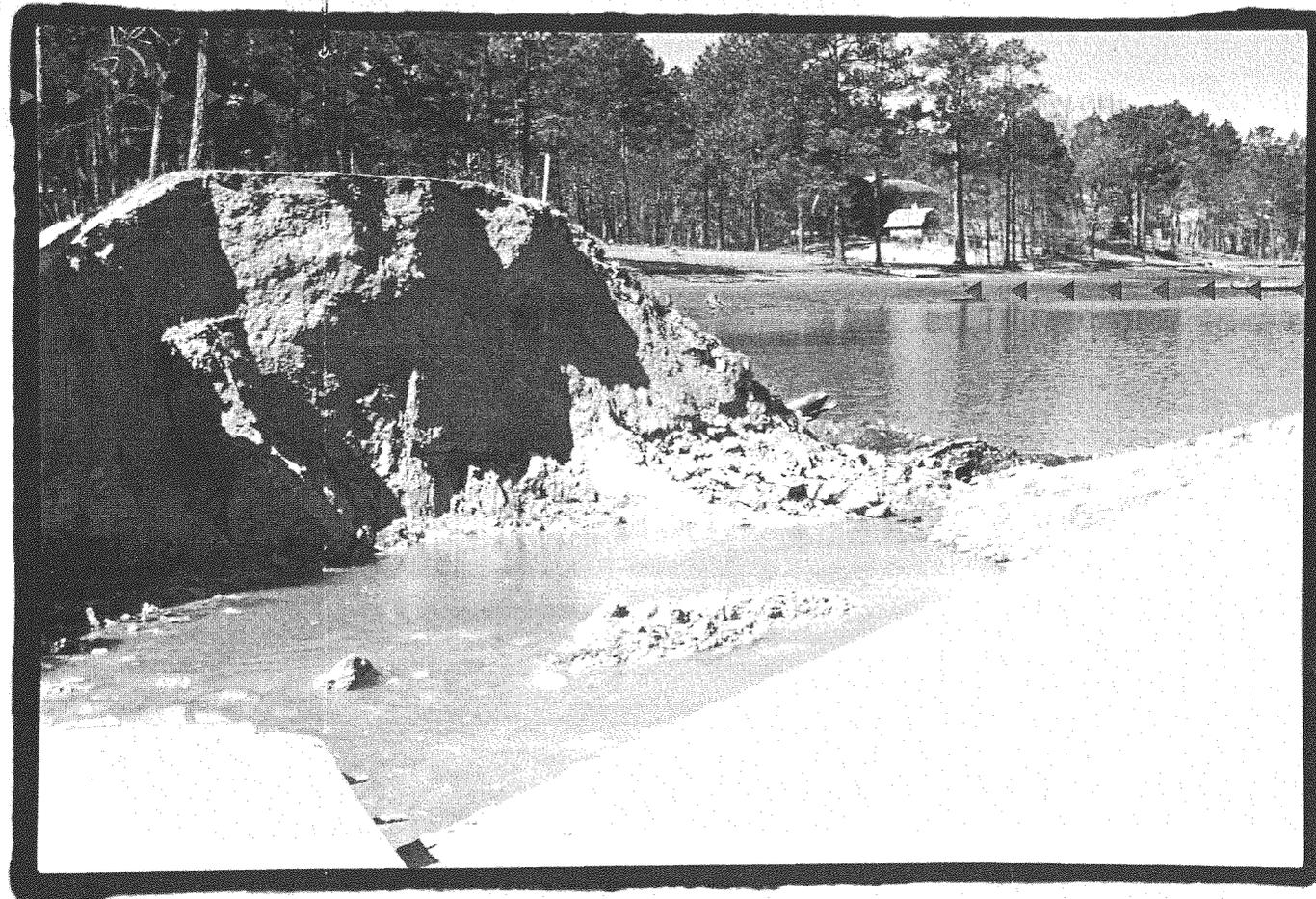
that an owner could face. ► ► ► ► ► ► ► ►

DAM FAILURE AND OWNER LIABILITY

The failure of a dam has the potential for catastrophic impact on communities, private property, and public works downstream. The record of dam performance suggests that there are approximately 10 to 20 failures per year involving uncontrolled release of the reservoir. Experience reveals that the failure of even small dams can result in serious injuries, fatalities, and extensive property damage.

LOSS FROM FAILURE

The cost of a dam failure is difficult to assess because flooding can affect large areas. The dam owner loses a valuable asset, and faces reconstruction costs and possible liability for downstream damages. Local communities may be directly impacted due to building damage, injuries, fatalities, lost water-



supply, damaged transportation and infrastructure, and lost recreational assets.

STRICT LIABILITY AND NEGLIGENCE

The extent of an owner's liability will vary from state to state, depending on the

statutes and case law precedents. The concept of strict liability imposes liability on a dam owner for damages that occur regardless of the cause of failure. The alternative theory of negligence considers the degree of

care employed by the owner in constructing, operating, and maintaining a dam. Historically, courts have sought to compensate those injured by a dam failure. When assessing liability, the standard of care

exercised by an owner will be closely examined. The standard of care should be in proportion to the downstream hazards involved. Where the risk is great, owners must be especially cautious. In many cases,

a dam regulated by the federal government or a state dam safety program must be designed to withstand an unprecedented flood or earthquake.

COMPLIANCE

Compliance with government or professional standards does not absolve an owner from liability, but it does establish a minimum standard of care to be used by owners. The extent of liability in any situation depends on the facts of the case and how those facts are interpreted by a judge or jury. Consequently, actions that result in owner liability in one state may not result in liability in different states. In general, a dam owner is required to use "reasonable care" in the operation and maintenance of a dam and reservoir.

RISK MANAGEMENT

▶ ▶ ▶ ▶ ▶ ▶

“In today's litigious society it is safe to assume that in the case of a catastrophic dam failure, extensive litigation will ensue. Any competent lawyer, representing the victims will sue all possible wrongdoers in seeking redress ... including ... the owners and operators of the facility, and ... architects, engineers, contractors, subcontractors, and consultants involved in the original construction and any subsequent modifications ...”

▲ An essential and logical part of an organization's management program is the control of potential losses that may arise. To manage risks, an owner can utilize a combination of standard operating procedures, employee training, regular maintenance, emergency preparedness and liability insurance.

▲ A dam owner can take several actions to protect against financial loss. Technical guidance and information is available from your state's Dam Safety office. ▲ Each dam should have:

- A state dam safety permit (if applicable)
- An operation plan, documented regular maintenance plan and emergency action plan
- Documented periodic inspections

- Warning signs and

MORE INFORMATION

For information on state dam safety statutes and administrative rules, contact:

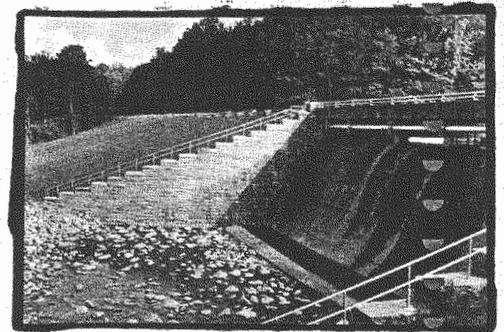
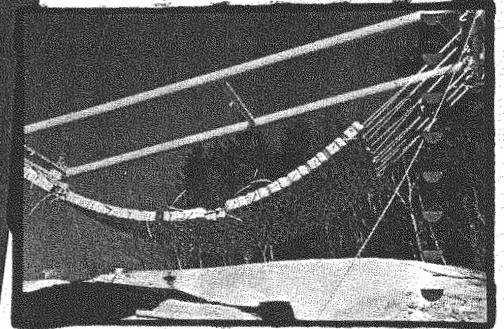
- State Dam Safety Office
- Association of State Dam Safety Officials
- State Attorney General's Office

Additional information and technical assistance can be obtained from the

following federal, state, and local agencies:

- Office of Emergency Services
- U.S. Army Corps of Engineers
- U.S. Department of the Interior, Bureau of Reclamation
- U.S. Department of Agriculture—Soil Conservation Service

DAM OWNERSHIP



ASSOCIATION OF STATE
DAM SAFETY OFFICIALS

450 Old East Vine Street
Lexington, Kentucky 40507
Tel (606) 257-5140

PROCURING THE SERVICES OF A PROFESSIONAL ENGINEER

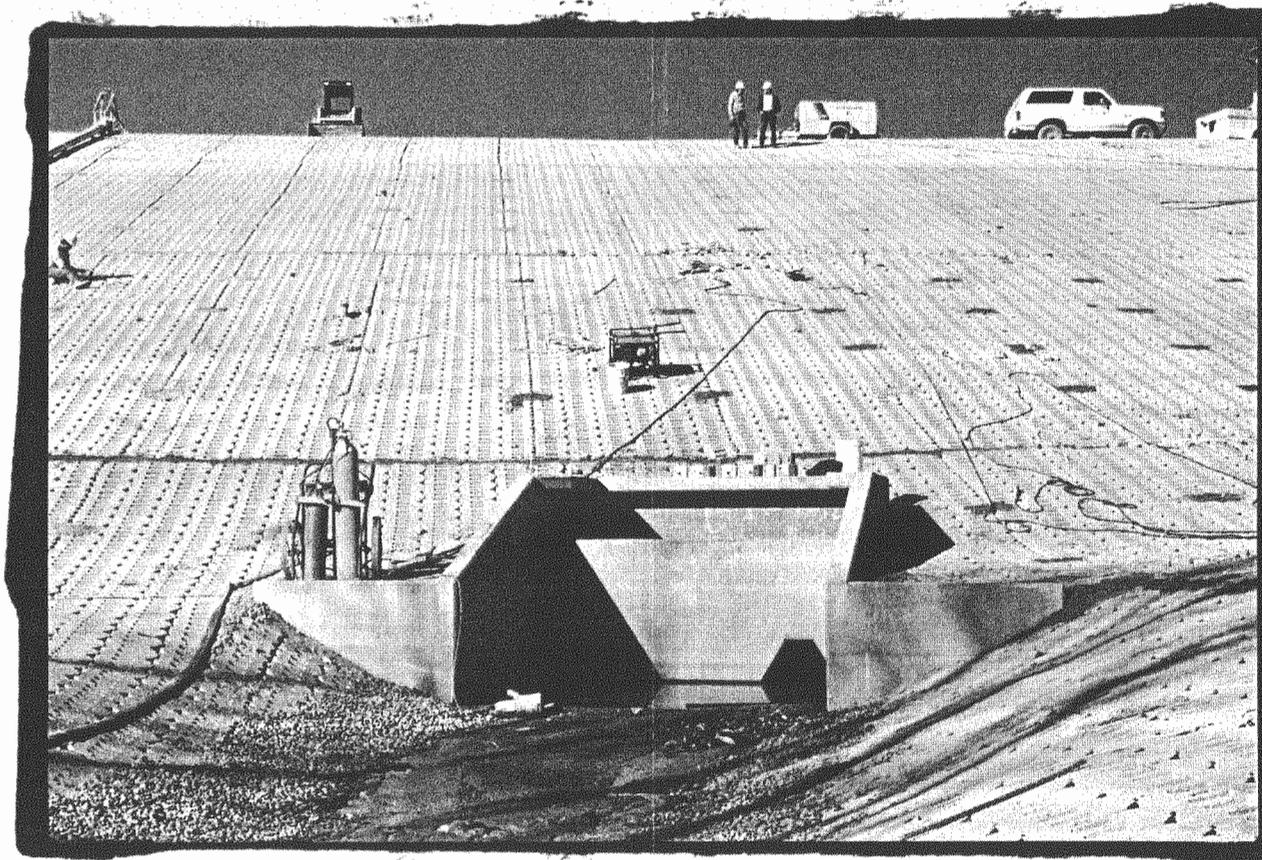


DAM MAINTENANCE AND OWNER RESPONSIBILITY

Dam owners receive important benefits from the reservoir impounded by the dam. The responsibility owners hold for understanding the laws and regulations associated with proper dam maintenance, and the procedures for keeping dam structures safe, is significant. This understanding could determine whether an owner will reap the benefits associated with responsible dam ownership or pay the costs resulting from improper dam maintenance. One of the most important procedures for ensuring proper maintenance of the dam is procuring the services of a professional engineer. This brochure is designed to answer the most commonly asked questions about hiring an engineer.

WHY DO I NEED AN ENGINEER?

► All dams meeting government regulatory definitions—no matter what their size or level of engineering—will deteriorate with time. Periodic inspection, proper maintenance, and occasional repair and rehabilitation are inevitable. An owner needs the expertise of an engineer to perform inspections or evaluate and undertake corrective measures at a dam. ► An engineer can investigate the problem and recommend a course of action



which may include the design of corrective measures and the preparation of construction plans and specifications. The engineer also can assist in selecting a contractor and will provide valuable construction inspection services.

WHAT TYPE OF ENGINEER SHOULD I HIRE?

► It is essential to select someone with a professional engineer (P.E.) certification, with a background in civil engineering, who is competent in the field of dam safety. Important

criteria to look for in a prospective engineer include the following:

- A licensed professional engineer;
- A minimum of 10 years experience in dam design and construction;
- A knowledge of the

rules and regulations governing dam design and construction in the state where the dam is located

- Specific experience in the problem area—e.g., hydrology, hydraulics, structural or geotechnical engineering. ► ► ►

HOW DO I CHOOSE AN ENGINEER WHO IS BEST FOR MY NEEDS?

► There are three basic strategies for selecting engineering consulting services. These selection strategies are:

- Qualification-Based
- Fee-Based
- Intermediate

QUALIFICATION-BASED

► Qualification-Based selection means that the knowledge, experience, and ingenuity of the engineer are the determining factors in making the selection. This strategy is advantageous when the owner is uncertain about the exact problem or the best solution to the problem.

► When Qualification-Based selection is used, several engineering firms submit their technical qualifications, experience with similar projects, reputation

with existing clients, and any other factors pertaining to the specific project. The owner then selects the three most qualified firms to make brief presentations outlining a cost-effective and innovative approach to the problem. Based upon these presentations, the owner chooses the most qualified engineer to develop a scope of work.

► When agreement on the scope of work is achieved, the engineer and the owner negotiate a price that is fair and reasonable to both parties. If an agreement cannot be reached, negotiations start with the second-ranked engineer. In this selection process, price is the main factor, but only after the most qualified engineer has been identified.

FEE-BASED

► Fee-Based selection



means that the engineer's fee is the only determining factor in making the selection. It is advantageous when the owner knows exactly what is needed and can clearly define the scope of work before meeting with an engineer. In this case, the engineer is requested to prepare the designs and bid documents as the owner specifies. This usually means getting a job done using "cookbook" solutions—with little room for innovation. ► A strict Fee-Based selection often

means that the engineer selected may not be qualified to do the work, especially if the bidding is open to anyone and/or the scope of work is poorly defined.

INTERMEDIATE

► The Intermediate option is a cross between the Qualification-Based selection and Fee-Based selection processes. The Intermediate option requires that the owner pre-qualify engineers that are asked to submit a fee-based proposal. This process ensures a higher certainty that the work will be of superior quality, but requires the owner to clearly define the scope of work. Without a clearly defined scope of work, the owner could receive a wide range of fee proposals, depending on the consulting engineer's interpretation of the project.

► Request references from the engineer. Contact the references to discuss the engineer's performance. Look at projects that have been completed under the engineer's leadership. Request to review state files of projects an engineer has undertaken to see if the process went smoothly.

► Maintain an open line of communication with regulatory agencies, particularly your State Dam Safety Program. Discuss an engineer's recommended course of action to verify that regulatory requirements will be satisfied.

► Educate yourself in the basics of dam safety and be knowledgeable regarding the laws you must meet.

► Carefully consider your selection of an engineer. A little work on your part in selecting the engineer

may save you money in the future. ► For information on state dam safety statute and administrative rules, contact:

- State Dam Safety Office
- ASDSO
- State Attorney General

REFERENCE MATERIALS

- Consulting Engineering: Guide for the Engagement of Engineering Services*, American Society of Civil Engineers Manual and Reports on Engineering Practice, No. 45., 1988
- Qualification-Based Selection*, American Consulting Engineer's Council, 1994
- Dam Safety: An Owner's Guidance Manual*, FEMA 145, August 1987
- Training Aids for Dam Safety*, *Dam Safety Awareness*, Interagency Committee on Dam Safety/U.S. Bureau of Reclamation, 1994

Table 2. Aquatic Weed Control Water Use Restrictions¹ (Number of days after treatment before use).

Common Name	Human		Fish Consumption	Animal Drinking		Irrigation		Agricultural Sprays
	Drinking	Swimming		Dairy	Livestock	Turf	Crops	
copper sulfate ²	0	0	0	0	0	0	0	0
copper complexes	0	0	0	0	0	0	0	0
2,4-D	*	*	*	*	*	*	*	*
diquat	14	1	0	14	14	5	14	14
endothall	7-14	1	3	7-14	7-14	7-14	7-14	7-14
fluridone ³	0	0	0	0	0	30	30	30
glyphosate ⁴	0	0	0	0	0	0	0	0

¹Algae control may result in a fish kill due to oxygen depletion if herbicides are applied to large areas, or when dissolved oxygen levels are low, or if fast-acting contact herbicides are used (diquat, copper sulfate, etc). Similar hazards exist when large masses of vascular plants or floating weeds are rapidly killed with herbicides.

²If water is used for drinking, the elemental copper concentration should not exceed 1.0 ppm (i.e., 4.0 ppm copper sulfate).

³Do not apply within 0.25 miles of any potable water intakes.

⁴Do not apply within 0.5 miles upstream of potable water intakes.

*Water restrictions vary with formulation and rate. Read the label.

crystals (copper sulfate) may be placed in burlap bags and dragged or suspended in the water until they dissolve.

Add surfactants according to individual product label directions. Surfactants enhance the spreading, wetting and penetration characteristics of selected foliar-applied herbicides (e.g., diquat, glyphosate). Use of surfactants is not recommended for submersed weed control treatments.

Herbicide dosage calculations

Aquatic herbicides are applied at labeled rates. Applying an excessive rate of a herbicide does not increase the level of weed control but does increase the cost of the treatment and may increase the risk of injury to fish. Conversely, applying less than the recommended rate usually does not control the weed.

In order to apply the recommended rate, the size and often the average water depth of the water body must be determined prior to herbicide application. Depending upon the chemical, herbicides are applied as a surface acre, bottom acre-foot or total water volume treatment.

Surface acre treatments:

The amount of herbicide needed for a surface acre treatment may be determined by the following formula:

$F = A \times R$

F = Amount of formulated herbicide product

A = Area of the water surface in acres

R = Recommended rate of product per surface acre

Acre-foot treatments:

Many aquatic herbicides list their application rates in terms of amount of product per acre-foot of water. An acre-foot of water is defined as one surface acre of water that is 1 foot deep. The number of acre-feet of water can be found by multiplying the number of surface acres times the average water depth. The amount of herbicide needed for an acre-foot treatment may be determined by the following formula:

$F = A \times D \times R$

F = Amount of formulated herbicide product

A = Area of water surface in acres

D = Average depth of water body in feet

R = Recommended rate of product per acre-foot

PPM treatments:

The treatment rate of certain aquatic herbicides may be listed as the final concentration of the chemical in the water body on a part per million weight (ppmw) basis. The amount of herbicide needed for a ppmw treatment may be determined by the following formula:

$F = (A \times D \times CF \times ECC) \div I$

F = Amount of formulated herbicide product

A = Area of the water surface in acres

D = Average depth of the water body in feet

CF = 2.72 lbs/acre-foot. The conversion factor (CF) when total water volume is expressed on an acre-foot basis.

2.72 lbs. of a herbicide per acre-foot of water is equal to 1 ppmw.

ECC = Effective chemical concentration of the active ingredient of a herbicide needed in water to control the weed.

I = The total amount of active ingredient divided by the total amount of active and inert ingredients.

For liquid products, I = pounds of active ingredient + one gallon

For dry products, I = percent active ingredient + 100%

Aquatic herbicides

The herbicides discussed in this section are labeled for use in commercial fish production ponds. The herbicide label should be read and fully understood prior to pond application.

Copper sulfate (Various trade names)

Copper sulfate is primarily used to control algae. It is a contact herbicide and quickly kills sensitive algal species. Copper can interfere with gill function and if improperly used can be toxic to fish. The majority of fish kills due to copper sulfate treatment are primarily caused by a massive algae kill and subsequent oxygen depletion problems.

The effectiveness and safety of copper sulfate is determined by alkalinity and water temperature. In waters with an alkalinity ≤ 50 ppm, the rate of copper sulfate needed to control algae can be toxic to fish. Treatment at water alkalinities of ≤ 20 ppm is extremely risky. In high alkalinity (≥ 250 ppm) waters, copper sulfate quickly precipitates out and is not effective for algae control. The toxicity of copper sulfate to fish increases as water temperature increases. Avoid copper sulfate applications during hot summer months.

Chelated Copper (Komeen, K-Tea, others)

Copper that is held in an organic complex is known as chelated copper. Chelated copper formulations do not readily precipitate in high alkalinity waters, but stay in solution and remain active longer than copper sulfate. Chelated copper is less corrosive to application equipment than copper sulfate. Due to its enhanced solubility, chelated copper is generally used at rates slightly lower than copper sulfate. Chelated copper formulations are slightly less toxic to fish than copper sulfate. However, in waters with low alkalinity (≤ 20 ppm), or in water with an alkalinity of ≤ 50 ppm that contains trout, chelated copper use is extremely risky, particularly during the hot summer months.

Diquat (Reward)

Diquat is a contact herbicide that can be used as a "pour-in" treatment for submersed weed and filamentous algae control or as a foliar application for duckweed (*Lemna minor* and *Spirodela polyrrhiza*) control. An approved nonionic surfactant is required when diquat is used as a foliar application. Diquat is tightly bound to clay micelles and is not effective for weed control in muddy water. Diquat quickly kills plants and

should be used as a partial pond treatment for dense vegetation.

Endothal (Aquathol, Hydrothol)

Two salts of endothal are used for aquatic weed control. A dipotassium salt is available as a granular or liquid formulation by the trade name of Aquathol. Hydrothol is available as a liquid or granular formulation and is a mono-(N,N-dimethyl-alkylamine) salt of endothal. Aquathol and Hydrothol vary considerably in their safety to fish and weed control spectrum. Hydrothol is more toxic to fish so consequently, Aquathol is generally used in commercial ponds. Hydrothol controls algae (filamentous and stoneworts) and many submersed weeds. Aquathol controls many submersed weeds but is not effective for algae control. Both Aquathol and Hydrothol are contact herbicides and may be used on a spot or partial pond treatment basis.

Fluridone (Sonar)

Fluridone controls most submersed and emersed weeds and is available as a liquid or pelleted formulation. Liquid formulations may also be used to control duckweed. Fluridone is a translocated herbicide that slowly kills plants over a 30- to 90-day period. The slow action of fluridone generally prevents the occurrence of weed decomposition-induced oxygen problems. Fluridone is not effective as a spot treatment. The entire pond must be treated to control the target weed species.

Glyphosate (Rodeo, Pondmaster)

Glyphosate is a foliar applied, translocated herbicide that is used to control most shoreline vegetation and several emersed weeds such as spatterdock (*Nuphar luteum*) and alligatorweed (*Alternanthera philoxeroides*). Glyphosate translocates from the treated foliage to underground storage organs such as rhizomes. Applications at the flowering or fruiting stage of perennial plants are generally more effective than earlier applications due to better translocation to underground plant parts. An approved nonionic surfactant should be used with glyphosate (Rodeo formulations only). Rainfall occurring within 6 hours of application will reduce the effectiveness of glyphosate.

2,4-D (Various trade names)

2,4-D is a translocated herbicide that is available as a granular or liquid formulation. Granular 2,4-D controls submersed weeds such as coontail

(*Ceratophyllum demersum*) and emersed weeds such as waterlily (*Nymphaea* spp.). Liquid formulations of 2,4-D are used to control floating weeds such as water hyacinth (*Eichhornia crassipes*) and several emersed weeds. 2,4-D is available as an ester or amine formulation, which is slightly better for aquatic applications. However, the liquid ester formulation is more toxic to fish than the amine. The granular ester form is safer to use in aquatic applications. There are numerous uses for 2,4-D, but only those labeled for aquaculture use are legal.

The information and suggestions included in this publication reflect the opinions of Extension fisheries specialists based on field tests and use experience. Our management suggestions are a product of research and are believed to be reliable. However, it is impossible to eliminate all risk. Conditions or circumstances which are unforeseen or unexpected may lead to less than satisfactory results even when those suggestions are used. Neither the Cooperative Extension Service nor the Southern Regional Aquaculture Center assumes responsibility for such occurrences. Such risk shall be assumed by the USER of this publication.

Suggested herbicides must be registered and labeled for use by the Environmental Protection Agency and the Department of Agriculture. The status of herbicide label clearances is subject to change and may have changed since this publication was printed. County Extension agents and appropriate specialists are advised of changes as they occur.

The USER is always responsible for the effects of herbicide residues on livestock and crops, as well as problems that could arise from drift or movement of the herbicide from his/her property to that of others. Always read and follow carefully the instructions on the container label.

The information given herein is for educational purposes only. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the Southern Regional Aquaculture Center or the Cooperative Extension Service is implied.

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