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PART I: BACKGROUND DATA

A. Introduction

Any Dam is located along an unnamed tributary of Any Creek, in Any Township, Any County, N.J. The dam forms an impoundment known as Any Lake. The lake and associated dam, are maintained by the Any Lake Community Association (ALCA), for whom this Operations and Maintenance (“O&M”) Manual has been prepared.

Any Dam is an earthfill embankment approximately 250 feet long and 14 feet high that was constructed in the 1930s. The dam was completely reconstructed in 1987 by Any Construction Company with the design completed by Any Engineering Company. The dam appears to consist of a mixture of native brown silty sand and gravelly sand. The components of the dam include an earth embankment, a gabion-lined spillway channel with a concrete sill, a low level outlet structure, four (4) subsurface drains, and two (2) observation wells. There is also a wood and metal bridge/walkway that crosses over the spillway channel at the left abutment.

The crest of the dam is approximately 15-foot wide and contains a 5-foot wide stone walkway and maintained grass. The upstream slope of the embankment consists of large rip rap mixed with small stones underlain by a geotextile. Gabion baskets, approximately 18 inches thick, are located adjacent to the contact between the upstream slope of the embankment and the primary spillway channel. The downstream slope of the embankment is gently sloping (approximately 6:1 slope) and consists mostly of grassy vegetative cover. Four (4) subsurface drains are located along the toe of the downstream embankment. It was noted during the May 16, 1997 regular inspection of the dam that only three (3) of the four (4) drains could be located. Two (2) observation wells were installed for geotechnical investigations during the design phase of the 1987 dam reconstruction and are not required to be monitored.

The primary spillway is a gabion-lined channel with a concrete sill. The entrance of the spillway channel begins with a concrete sill, approximately 40 feet in length and 1.5 feet in depth, at the left abutment. The spillway channel winds around the upstream toe of the embankment at the left abutment and discharges flow near the downstream toe of the embankment at the left abutment. There are several steps, approximately 18 inches in depth, along the spillway channel.

The low level outlet is a gated outlet structure consisting of two (2) headwalls and an 18-inch reinforced concrete pipe (“RCP”). One headwall is located at the upstream toe of the embankment near the right abutment and contains a valve for controlling flow through the 18-inch RCP outlet. The gated outlet control is surrounded by water and would require hip waders and a small ladder to access. The other headwall is located at the downstream toe of the embankment near the right abutment and contains the outlet to the 18-inch RCP.

B. Project Description

In accordance with the New Jersey Department of Environmental Protection (“NJDEP”) Dam Safety Standards (“DSS”), NJAC 7:20, a “regular inspection” of the dam was performed by Any Engineering in May 1997. Prior inspections were performed by Another Engineering in 1993 and 1990 respectively. A Phase I inspection of the dam has not been conducted.

A regular inspection means the visual inspection of a dam by a New Jersey licensed professional engineer to check for any signs of deterioration in material, or weakness/deficiencies in hydraulic or structural behavior. At the time of the last regular inspection, recommendations were made to implement remedial action at the dam. Some of the recommendations made in the 1997 inspection report have been implemented.

This O&M Manual will provide a mechanism by which additional remedial repairs and routine maintenance items can be performed to avert long-term degradation of the spillway and embankments. “Informal inspections” also identified herein as “maintenance inspections” must be performed by the designated Inspector appointed by the ALCA (“Informal inspection” means the visual inspection of the dam by the owner to detect any signs of deterioration in the structure.)

In accordance with NJDEP files, Any Dam has been classified as a low hazard potential Class III structure. Due to the Class III designation for the dam, NJDEP DSS mandate that a “regular inspection” be performed by a New Jersey licensed professional engineer (“P.E.”) once every four years. A proposed inspection schedule is tabulated in Part II Section, G.

C. Project Authorization

This O&M Manual has been prepared in accordance with the NJDEP DSS, Section 7:20-1.11 “Dam Operating Requirements and Inspections: New and Existing Dams. This manual was prepared by Any Engineer at the request of the ALCA.

The ALCA contracts directly with outside contractors for maintenance of common areas within the Any Lake Community, which includes both the dam and the reservoir. Periodic maintenance of the dam is performed by Any Construction, Inc.

ALCA is the record owner and operator of the dam. The earthen dam, the reservoir (lake), the primary spillway, and the low-level outlet are privately held by the ALCA.

D. Project History

As discussed in the Introduction (Part I, Section A), the dam was apparently constructed during the 1930's and was completely reconstructed in 1987. Design and construction documents for the most recent reconstruction were reviewed by the NJDEP Bureau of Dam Safety. As discussed in the Project Description (Part I, Section B), the dam was inspected in 1990, 1993 and 1997. At that time, recommendations were made for remedial actions.

The recommendations included:

- 1) Fill and compact any existing animal burrows (1997)
- 2) Remove all brush and woody vegetation from the upstream slope of the Embankment (1990, 1993, 1997).
- 3) Investigate the condition of the subsurface drain at the right abutment adjacent to the low level outlet pipe (1997).
- 4) Clear small trees and thicket on downstream toe of dam to about 10 feet beyond current mow-line (1997).
- 5) Observe and clean all subsurface drains once every two years, as necessary to remove blockage (1990, 1993, 1997).

E. Project Contracts

Miscellaneous Correspondence (Part I, Section F) contains correspondence and contract information regarding general maintenance and material purchases for the Dam. Any new correspondence or contract data must be copied and included in Miscellaneous Correspondence (Part I, Section F).

F. Miscellaneous Correspondence

A record of routine or corrective maintenance performed by the ALCA will be kept and included as a part of this manual. This section shall contain an ongoing record of relevant correspondence regarding Dam Compliance History. It shall include correspondence from the Bureau of Dam Safety regarding compliance issues, dam classification/reclassification, and professional services. This section shall be reviewed and updated annually along with the entire O & M manual to incorporate pertinent correspondence.

G. Glossary of Terms

The following terms are provided so that the members of the ALCA will be familiar with terms relating to the dam.

Abutment – That part of the natural ground against which a dam is constructed. Right and left abutments are those respective sides of an observer looking downstream.

Appurtenant Structures – Ancillary features of a dam, such as the outlet pipe, spillway and sluice gate.

Crest – The term “crest of dam” is often used when “top of dam” is meant.

Dam – A barrier built across a watercourse for impounding water.

Drainage Area – The area that drains naturally to a body of water.

Embankment – A slope of fill material, usually earth or rock, that is longer than it is high or the sloping side of a dam.

Homogeneous Earthfill Dam – An embankment dam constructed of similar earth material throughout.

Freeboard – The vertical distance between a known water surface elevation and the top of a dam.

Normal Water Level - The lowest level of the spillway over which water normally flows.

Outlet Pipes – The opening at the dam through which water can be freely discharged from the reservoir.

Piping - The progressive development of internal erosion by seepage, appearing downstream as a hole or seam discharging water that contains soil particles.

Probable Maximum Precipitation (PMP) – The maximum amount of rainfall that can be expected to occur on a drainage area.

Reservoir Area - The surface area of the lake when filled to the normal water level.

Rip rap – A layer of large stones, broken rock, or precast blocks placed in random fashion on the slope of an embankment dam, on a reservoir shore, or in the channel as a protection against wave action or erosion. Very large rip rap is sometimes referred to as armoring.

Seepage – The internal movement of water that may take place through small spaces in a dam, its foundation, or its abutments.

Sluice Gate – A gate controlling the outflow of water from the reservoir.

Spillway – A structure over which normal or flood flows are discharged.

Toe of Dam – The junction of the downstream face of a dam with the ground surface, also referred to as downstream toe. Also known as the junction of the upstream face with ground surface, called the upstream toe, which is usually under water.

II: Operation and Maintenance

A. General

A well organized O&M program will protect the dam against deterioration and prolong its life. All components of the dam including the embankment, the spillway, and the reservoir are susceptible to damaging deterioration over time. The cost of a proper O&M program is minuscule compared to the cost of major repairs for reconstruction of the dam after a failure. This manual establishes a basic O&M program based primarily on systematic inspections by appointees of the ALCA. During each inspection a checklist of items as defined in Inspections and Inspection Checklist (Part II, Section E) must be used. The completed checklist must be dated and signed by the “Inspector” and incorporated into this manual.

This manual is intended as a guide for the ALCA and outlines the proper procedures for conducting routine O&M for the dam. The ALCA shall appoint a key site person, from within their organization (Inspector), who will perform inspections for the year. This manual will then be transferred yearly to the appointed “Inspector.” A continuous record of the O&M for the dam must be maintained. The Designated Inspectors List (Part II, Section B) lists the Officials and various contractors. This section must be updated periodically pending a change in the Officials, the Inspector, the Engineer, or the Contractor.

At least two (2) copies of this manual shall be kept by the ALCA at all times. All correspondence and dam maintenance checklists shall be reproduced in triplicate and distributed for inclusion into the manuals. One (1) copy of this manual along with all updates and inclusions shall be forwarded to:

New Jersey Department of Environmental Protection
Engineering and Construction
Division of Dam Safety & Flood Control
Bureau of Dam Safety
501 East State Street
Mail Code 501-01A
P.O. Box 420
Trenton, New Jersey 08625-0420

This section of the manual has been prepared to provide the Inspector with a simple and systematic method for inspecting, operating and maintaining the dam. For the most part, the O&M for the dam involves observation rather than evaluation. The following sections provide a step-by-step procedure to assist the Inspector in performing all duties in a rational and orderly manner. The Inspector must become familiar with the background information in Part I of this manual. The Inspector must also review the plans which are included in Part II, Section C.

Finally, prior to conducting an inspection or performing routine O&M, the Inspector must review the Tools and Equipment List (Part II, Section D), the Inspections and Inspection Checklist (Part II, Section E) and the “Guide for Preparation of Report on Conditions of Dam (Part II, Section I) of this manual. Each time an inspection reveals the need for maintenance, the Inspector shall notify the ALCA who may hire a contractor to perform the work under the direction of a NJ Licensed Engineer. Each time maintenance is performed on the dam, the Inspector must record the incident and place a copy of the maintenance checklist in this manual Part II, Section F. Inspections must be performed once every year between March and May and after each major storm event. Routine maintenance, as defined in Part II, Section F, shall be performed immediately after each inspection and after each major storm event.

B. Designated Inspectors List

This Section must be updated periodically to reflect the name(s) and telephone number of the Inspection and Contractors who are appointed by the ALCA.

Inspectors (1996-1997)

Telephone Number

Designated Contractor (1998)

Professional Engineer (1998)

1998 Officers

C. Plan Review

This section contains existing plan documents. This section shall be periodically updated to incorporate additional plans and sketches that are developed for the operations, maintenance, inspection or rehabilitation of the dam and its ancillary features. The Inspector shall review available plans prior to conducting an inspection of the dam.

D. Tools and Equipment

The following is a list of required inspection equipment for routine O&M procedures and Inspections.

1. A clip board, a pencil and the inspection checklist – the inspection checklist is included in the following section.
2. A standard 6-foot collapsible ruler.
3. A camera – photographs or observed portions of the dam will provide a measure of performance when comparing past and present maintenance practices or conditions.
4. A probe – any stiff light stick or rod with a blunt tip of sufficient strength to penetrate soil. The probe can provide information on conditions below the surface of the dam such as the depth and softness of a saturated area.
5. A weed whacker – can be used to clear non-visible areas and to perform routine maintenance on the embankments.
6. A flashlight – a flashlight can be used to observe the inside of the 18 inch Outlet Pipe and the 6 inch PVC subsurface drains.

Maintenance at the dam may include heavy equipment including the following:

1. Chain saw.
2. Stimp grinder.
3. Wheelbarrow.
4. Backhoe.
5. Dump truck.

Sources of the following materials should be identified for immediate use of warranted by the inspection.

1. Native, silty sand for filling erosion rills and gullies.
2. Topsoil mixture, fertilizer and seed.

3. Large stone rip rap for emergency repairs caused by erosion.
4. Synthetic geofabric netting and stakes to prevent seed and top soil from blowing away.

E. Inspections and Inspection Checklist

Prior to performing inspections, the Inspector must observe the water level in the lake and on the outlet side of the dam. No amount of water should flow over the spillway during an inspection. (The lake must be lowered by operating the gate at the low level outlet). This procedure allows the Inspector to freely observe the spillway. If the inspector identifies a need for immediate maintenance of the spillway, the lake should be lowered an additional amount by opening the low level outlet to facilitate the repair. Prior to lowering the lake, an application for Lake Lowering must be filed with the NJDEP, Division of Fish, Game and Wildlife. A sample application is included in Part II, Section H of this manual.

The most effective means of conducting the inspection is to treat each dam component as an individual element, inspect it thoroughly, and fill out the checklist prior to moving on to the next element. The checklist sequence for inspection of each dam element is as follows:

1. The crest: walk along the top of the dam from one end to the other (generally defined by the paved walkway) and look for erosion, puddles, or settlements, cracks in the walkway surface or animal burrows, etc.
2. The upstream embankment: walk along the upstream face of the dam and to the water's edge and observe erosion, puddles or wet areas, slumps, wood vegetation or animal burrows. (Look below the waterline for any additional irregularities or animal burrows.
3. The downstream embankment: walk along the downstream face of the dam in a zigzag, top to bottom fashion to observe any erosion, puddles or wet areas, slumps, woody vegetation or animal burrows.
4. Spillways: observe the spillways from the crest. Walk along the concrete sill noting any cracks, leaks, heaving or erosion. Check the abutment-spillway interface for any sign of erosion.
5. Outlets: Observe the condition of the outlet culvert at the upstream headwall. Check the condition of the RCP to note any blockage or cracks. (In order to view the outlet culvert, it will be necessary to lower the water level in the lake. Prior to lowering, notify downstream owners and the Township. Using chest waders and a ladder access the control valve on top of the upstream headwall to lower the level of the lake. Once the lake is lowered, the valve should be operated through

its full range, however, the valve must be closed for inspection of the spillway.) Observe the condition of the 18" RCP by viewing it from the upstream and downstream end.

6. The lake: stand on the upstream face on the crest (paved walkway) and look upstream to observe any irregular conditions within the lake that may ultimately impact the dam or the spillway.
7. The downstream area: Walk along the bed of the downstream channel and observe any unusual conditions which may effect the performance of the dam, such as debris, vegetation or excessive sedimentation. Observe the gabion baskets that line the channel to ensure that they are intact and in good condition.
8. Subsurface drains: Locate each of the four (4) subsurface drains located along the toe of the downstream embankment. Using a flashlight, inspect each of the 6-inch slotted PVC pipes for flow conditions, obstructions or cracking.

The inspection checklist included in this section should be copied and completed every time an informal (maintenance) inspection is performed. In general, informal inspections should be performed every two years between March and May. After each inspection, the Inspector will report to the ALCA, which will direct maintenance operations as necessary.

ALCA
INSPECTION CHECKLIST

Dam Name: Any Dam

NJDEP Dam File No.:

Maintenance Crew: _____ Date: _____ Weather: _____

- Directions:**
1. Lower the lake prior to conducting inspection.
 2. Mark an "X" in yes, no or N/A column and note any unusual condition.

OBSERVED ITEM	YES	NO	N/A	DIMENSIONS, LOCATIONS, COMMENTS, ETC.
Crest: (Walk along top of dam from one end to the other)				
a. Observed cracks? (how long?)				
b. Observed ruts or holes? (how big?)				
c. Trees? (how many?)				
d. Observed settlements?				
e. Observed erosion gullies?				
f. Observed bare areas?				
g. Animal burrows?				
Upstream Slope: (start at top and walk up and down slope across entire dam)				
a. Observed ruts or holes?				
b. Trees? (how many?)				
c. Observed slumps or settlements?				
d. Observed erosion gullies?				
e. Observed bare spots?				
f. Animal burrows?				
g. Wet areas or seepage?				
Downstream slope: (start at top and walk up and down slope across entire dam)				
a. Observed ruts or holes?				
b. Trees? (how many?)				
c. Observed slumps or settlements?				
d. Observed erosion gullies?				
e. Observed bare spots?				
f. Animal burrows?				
g. Wet areas or seepage?				

OBSERVED ITEM	YES	NO	N/A	DIMENSIONS, LOCATIONS, COMMENTS, ETC.
Primary Spillway:				
a. Debris or obstruction in spillway?				
b. Is spillway straight?				
c. Are gabions intact?				
d. Observed cracks or leakage?				
Downstream Channel: (Walk down channel bed)				
a. Debris in channel?				
b. Excess sediment build up?				
c. Excessive vegetation?				
d. Are gabion baskets intact?				
e. Evidence of uneven settlement?				
f. Other conditions?				
Low level outlet:				
a. Observed blockage?				
b. Joints misaligned?				
c. Joints leaking?				
d. Is valve operable?				
e. Observed cracks in headwall?				
f. Observed spalling or scaling?				
g. Exposed reinforcing steel?				
Subsurface drains: (4 - 6" PVC pipes at toe of dam)				
a. Observed flow from drain?				
b. Is water cloudy?				
c. Observed cracks?				
d. Observed blockage?				
e. Joints misaligned?				
Lake Area: (stand near crest and look upstream around lake)				
a. Observed excessive silt?				
b. Is plant growth excessive?				
c. Is water cloudy?				
d. Are shores eroded?				
e. Other observations?				
Recommendations for Maintenance:				

F. Operation and Maintenance and Routine Maintenance Checklist

The ALCA is responsible for maintenance at the Dam. There are three (3) categories of maintenance: immediate maintenance, corrective maintenance, and continuing maintenance. Accordingly, each of the maintenance conditions will be determined during the annual inspection. This portion of the report also contains a section on technical guidance describing corrective action.

1. Immediate maintenance demands immediate attention, requires notification of the Bureau of Dam Safety, and must be performed under the supervision of a New Jersey licensed professional engineer. Immediate maintenance usually requires construction equipment and professional guidance. Immediate maintenance is characterized by the following:
 - a. A severe slope failure.
 - b. A breach or near breach caused by severe progressive erosion.
 - c. Overtopping of the crest by upstream or downstream waters.
 - d. Deterioration of the outlet culvert.
 - e. Increasing uncontrolled seepage through the embankment.
 - f. A blocked spillway or outlet channel.

2. Corrective maintenance should be performed as soon as possible after an inspection, and may require a Dam Safety Permit. A dam permit application is included in Part II, Section H of this manual. Corrective maintenance consist of the following:
 - a. Clearing of trees, shrubs and underbrush on the dam embankment, crest, or near the spillway.
 - b. Filling eroded areas or gullies and seeding to stabilize the area.
 - c. Repairing or greasing the stem of the outlet gate.
 - d. Removal of burrowing animals and filling the holes.

Corrective maintenance can be performed by the ALCA volunteers with some technical guidance.

3. Continuing maintenance will occur on a regular basis and can be performed during the informal inspections or in accordance with maintenance schedule outlined in Part II, Section G of this manual. Continuing maintenance includes:
 - a. Observation of any wet areas, springs or potential seepage in the embankment:
 - b. Removing small shrubs or underbrush on the dam embankment:
 - c. Filling small eroded gullies:
 - d. Filling of ruts caused by pedestrian traffic along the crest:
 - e. Removing accumulated trash and debris:
 - f. Monitoring upstream development within the watershed:
 - g. Operating and greasing the stem at the outlet gate:
 - h. Removal of burrowing animals and their dens from the dam.
 - i. Fertilizing and overseeding grassed area.
 - j. Mowing grass areas.

Continuing maintenance can be performed by the Inspector or volunteers of the ALCA on an ongoing basis. Some technical guidance for routine operations follows.

4. Technical Guidance (Outlet Valve and Animal Burrows)

The proper operation of the outlet gate and burrowing animal control are critical to the proper operation of a dam. The technical maintenance tips provided in this section should be followed to insure proper dam operation.

Animal burrow control is a key feature of the O&M of the dam. Rodents such as woodchucks, muskrats, ground squirrels, rabbits, moles, and beavers endanger the structural integrity of the embankment. Animal burrows are easily recognized in the spring because fresh soil is generally found at the mouth of the burrows. Early detection and control in April is essential in controlling burrowing activity. Muskrats are nocturnal and can be found in marshy areas. Their burrows are difficult to detect since they tend to burrow below the water line. Beaver activity will become apparent through visual observation of tree cuttings. Animals should be removed immediately upon detection. Woodchucks, squirrels, rabbits, moles and muskrats can be exterminated or flushed out with smoke. Beavers must be relocated. The animal burrow must be filled with soil or a

mixture of water to 9 parts soil and 1 part cement. The soil mixture should be placed as deep as possible and compacted with a pole.

The proper operation of the outlet gate is critical to the operation of the dam. The outlet gate at the dam provides the only means for the emergency lowering of the lake which is essential for the safe operation of the dam. The gate must be operated through its full range and inspected once per year during the maintenance inspections. Observed irregularities or leakage in the operation of the gate should be investigated and corrected immediately.

**ALCA
CONTINUING MAINTENANCE CHECKLIST**

Dam Name: Any Dam

NJDEP Dam File No.:

Maintenance Crew: _____ Date: _____ Weather: _____

Directions: Mark an "X" in yes or no column.

MAINTENANCE ITEM	YES	NO	LOCATION AND EQUIPMENT USED
Crest:			
a. Remove trash			
b. Fill ruts and holes			
c. Fill potholes in pavement			
d. Remove trees and shrubs, etc.			
Upstream Slope:			
a. Remove trash			
b. Fill ruts, holes and gullies			
c. Fill and compact animal burrows (remove rodents)			
d. Remove trees and shrubs, etc.			
e. Replace stone rip rap			
Downstream slope:			
a. Remove trash			
b. Fill ruts, holes or gullies			
c. Fill and compact animal burrows (remove rodents)			
d. Remove trees and shrubs, etc. (10 feet from mow line)			
e. Fertilizer and overseed grass areas			
Subsurface drains:			
a. Clean out drains			
b. Repair any cracked pipes			
Outlet culvert:			
a. Clean out debris			
b. Patch joints			
Low level outlet valve:			
a. Operate valve			
b. Lubricate valve			
Lake Area:			
a. Remove trash			
b. Remove excess growth			
c. Repair erosion			

G. Schedule of Inspection and Maintenance

The following schedule shall be minimum requirements for inspections (see checklist in Section E). The dam shall have an informal (Maintenance) inspection performed once every year beginning in 2017 (except when a Regular Inspection is scheduled) or after any significant storm event. A Regular Inspection for the dam shall be performed every four years beginning in 2020. All inspections will be performed between March and May or between September and November. The following table shows the inspection schedule for the first 10 years. Subsequent inspections shall follow the same format.

Type of Inspection	Year
Regular	2016 (Done)
Informal	2017
Informal	2018
Informal	2019
Regular	2020
Informal	2021
Informal	2022
Informal	2023
Regular	2024
Informal	2025

All maintenance items identified in the inspections shall be completed during May for the spring inspection, or during November, for the fall inspection of the same year (see checklist in Part II, Section F). In addition, continuing maintenance shall be performed during each inspection and after every major storm event (see checklist in Part II, Section F).

H. Permit Applications

This section contains current permit applications and guidelines which may be applicable in order to carry out proper maintenance of the dam structures.

I. “Guide for Preparation of Report on Conditions of Dams”.

This section contains a guide which has been prepared by the NJDEP for use in inspection a dam and preparing the necessary documentation for “Regular Inspections.”