RAPPAHANNOCK RIVER BASIN

Name Of Dam: White Oak
Location: Madison County, State of Virginia
Inventory Number: VA 11301

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

HA073625

MARCH 1979
PREPARED FOR
NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

BY
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BEAVER, PENNSYLVANIA 15009

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Dams - VA  
National Dam Safety Program Phase I  
Dam Safety  
Dam Inspection  

(See reverse side)
20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.
PREFACE

This report is prepared under guidance contained in the
Recommended Guidelines for Safety Inspection of Dams, for
Phase I Investigations. Copies of these guidelines may be
obtained from the Office of the Chief of Engineers, Washington,
D.C. 20314. The purpose of a Phase I investigation is to
identify expeditiously those dams which may pose hazards to
human life or property. The assessment of the general
condition of the dam is based upon available data and visual
inspections. Detailed investigation and analyses involving
topographic mapping, subsurface investigations testing, and
detailed computational evaluations are beyond the scope of a
Phase I investigation; however, the investigation is intended
to identify any need for such studies.

In reviewing this report, it should be realized that the
reported condition of the dam is based on observations of
field conditions at the time of inspection along with data
available to the inspection team. In cases where the reser-
voir was lowered or drained prior to inspection, such action,
while improving the stability and safety of the dam, removes
the normal load on the structure and may obscure certain
conditions which might otherwise be detectable if inspected
under the normal operating environment of the structure.

It is important to note that the condition of a dam depends
on numerous and constantly changing internal and external
conditions, and is evolutionary in nature. It would be
incorrect to assume that the present condition of the dam
will continue to represent the condition of the dam at some
point in the future. Only through continued care and
inspection can there be any chance that unsafe conditions be
detected.

Phase I inspections are not intended to provide detailed
hydrologic and hydraulic analyses. In accordance with the
established guidelines, the spillway design flood is based
on the estimated "Probable Maximum Flood" for the region
(flood discharges that may be expected from the most severe
combination of critical meteorologic and hydrologic conditions
that are reasonably possible), or fractions thereof. Because
of the magnitude and rarity of such a storm event, a finding
that a spillway will not pass the design flood should not be
interpreted as necessarily posing a highly inadequate condi-
tion. The design flood provides a measure of relative
spillway capacity and serves as an aid in determining
the need for more detailed hydrologic and hydraulic studies,
considering the size of the dam, its general condition
and the downstream damage potential.
PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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NAME OF DAM: WHITE OAK
PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: White Oak
State: Virginia
County: Madison
Stream: White Oak Run
Date of Inspection: 28 November 1978

BRIEF ASSESSMENT OF DAM

White Oak Dam is an earth dam approximately 65 feet high and 500 feet long. The dam is owned and operated by the Town of Madison, Virginia and was designed by the U.S. Soil Conservation Service (SCS). The visual inspection and review of as-built drawings indicated no serious deficiencies requiring emergency attention.

According to Corps of Engineers' criteria, the dam should pass a spillway design flood equal to the Probable Maximum Flood. The dam will safely pass 67 percent of the Probable Maximum Flood without overtopping. Therefore, the spillway is inadequate but not seriously inadequate. Evidence of seepage or slope instability that would threaten the integrity of the structure was not observed. However, stability analyses completed during the design of the dam show that upstream and downstream berms recommended during the design were not shown on the design drawings and were not constructed. The available design documents do not explain the omission of the berms. Re-examination of the embankment stability is recommended within one year of the date of this report.

Recommended remedial measures to be scheduled during the annual operation and maintenance inspection program are to:
remove debris from the reservoir area, remove small trees and brush from the embankment, and repair animal burrows.

MICHAEL BAKER, JR., INC.

SUBMITTED: JAMES A. WALSH
James A. Walsh
Chief, Design Branch

RECOMMENDED: ZANE M. GOODWIN
Zane M. Goodwin
Chief, Engineering

APPROVED: Douglas L. Haller
Douglas L. Haller
Colonel, Corps of Engineers
District Engineer

Date: MAR 23 1979

NAME OF DAM: WHITE OAK
PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAM: WHITE OAK ID# VA 11301

SECTION 1 - PROJECT INFORMATION

1.1 General

1.1.1 Authority: Public Law 92-367, 8 August 1972 authorized the Secretary of the Army, through the Corps of Engineers to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams. The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Description of Project

1.2.1 Description of Dam and Appurtenances: White Oak Dam is a zoned, earthfill dam approximately 65 feet high and 500 feet long. Seepage control is provided by an impervious core, cutoff trench, and seepage drains. The seepage drains to the left (east) and right (west) of the outlet pipe lie along the toe of the dam and consist of filter material and perforated 6 inch B.C.C.M.P. Both drains exit into the stilling basin beside the outlet pipe.

The 75 foot wide, vegetated, side-channel, emergency spillway is located outside the right abutment of the dam. The approach channel slope is about 2% to the level control section which is 30 feet long. The discharge slope of the emergency spillway is about 15%.

The principal spillway is a drop-inlet structure consisting of a reinforced concrete riser, a 36 inch diameter reinforced concrete outlet pipe, and a riprap-lined stilling
basin approximately 40 feet wide and 60 feet long. A steel catwalk, 2.5 feet wide and supported by four piers, provides access to the riser (see Photo 1).

The reservoir is used for flood control and water supply. There are two 25 inch high by 36 inch wide orifices which are located on the upstream and downstream faces of the riser. The invert elevation of the orifices is 581.3 feet M.S.L. which maintains normal pool of the reservoir. The high stage riser crest is at an elevation of 586.5 feet M.S.L. Three water supply gates are located on the right (southwest) side of the riser with invert elevations at 559.0, 572.5, and 577.0 feet M.S.L. The 36 inch slide gate, which is used as a reservoir drain, and one water supply gate are located on the left (northeast) side of the riser with invert elevations of 547.0 and 558.0 feet M.S.L., respectively. The plan and typical sections of the dam are shown on Plates 1, 2, and 3.

1.2.2 Location: White Oak Dam is located on White Oak Run approximately 3 miles west of the Town of Madison in Madison County, Virginia. A Location Plan is included in this report.

1.2.3 Size Classification: The maximum height of the dam is 65 feet, and the reservoir storage capacity to the top of dam elevation is 2229 acre-feet. Therefore, the dam is in the "intermediate" size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

1.2.4 Hazard Classification: Two farms are located along White Oak Run immediately downstream (within the first mile) of the dam. Due to the close proximity of these habitable structures and the possible loss of life in event of failure as defined by Section 2.1.2 of the Recommended Guidelines for Safety Inspection of Dams, White Oak dam is considered in the "high" hazard category. The hazard classification used to categorize dams is a function of location only and has nothing to do with its stability or probability of failure.

NAME OF DAM: WHITE OAK
1.2.5 Ownership: The dam is owned and operated by the Town of Madison, Virginia with maintenance assistance from the Culpeper Soil and Water Conservation District and the regional U.S. Soil Conservation Service (SCS).

1.2.6 Purpose of Dam: The dam is used for water supply and flood control within the Rappahannock River Basin.

1.2.7 Design and Construction History: The existing facility was designed for the owner by the SCS. The dam, completed in 1965, was built by Moore, Kelly and Reddish, Inc.

1.2.8 Normal Operational Procedures: Except for water supply, operation of the dam is automatic. Normal pool is maintained by the orifice inlets on the riser with invert elevations of 581.3 feet M.S.L. The crest of the principal spillway is located at an elevation of 586.5 feet M.S.L. Excess flow is diverted through the emergency spillway which has a crest elevation of 592.0 feet M.S.L. The reservoir drain with an invert elevation of 547.0 feet M.S.L. can be used to dewater the reservoir.

1.3 Pertinent Data

1.3.1 Drainage Area: The drainage area of White Oak Dam is 5.06 square miles.

1.3.2 Discharge at Dam Site: The maximum discharge at the dam site was estimated at approximately 250 c.f.s. (includes flow from principal and emergency spillways), based on the June 1972 flood with a depth in the emergency spillway of about 0.5 foot.

Principal Spillway:
- Pool level at emergency spillway crest: 198 c.f.s.
- Pool level at top of dam: 221 c.f.s.

Emergency Spillway:
- Pool level at top of dam: 9050 c.f.s.

NAME OF DAM: WHITE OAK
1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are shown in the following table:

### TABLE 1.1 DAM AND RESERVOIR DATA

<table>
<thead>
<tr>
<th>Item</th>
<th>Elevation feet M.S.L.</th>
<th>Area acres</th>
<th>Acre-feet (a)</th>
<th>Watershed Length (a) inches</th>
<th>Length feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top of dam</td>
<td>603.8</td>
<td>100.5</td>
<td>2229</td>
<td>8.26</td>
<td>5700</td>
</tr>
<tr>
<td>Maximum pool,</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>design surcharge</td>
<td>600.4</td>
<td>89.0</td>
<td>1889</td>
<td>7.00</td>
<td>5200</td>
</tr>
<tr>
<td>Emergency spillway crest</td>
<td>592.0</td>
<td>68.9</td>
<td>1239</td>
<td>4.59</td>
<td>4400</td>
</tr>
<tr>
<td>Principal spillway crest</td>
<td>586.5</td>
<td>57.5</td>
<td>895</td>
<td>3.32</td>
<td>3800</td>
</tr>
<tr>
<td>Normal pool (b)</td>
<td>581.3</td>
<td>49.4</td>
<td>629</td>
<td>2.33</td>
<td>3200</td>
</tr>
<tr>
<td>Streambed at centerline</td>
<td>539.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

(a) Total storage -- includes 129 acre-feet of sediment storage and 500 acre-feet of water supply storage below normal pool.

(b) Invert of the two 25 by 36 inch orifices.

NAME OF DAM: WHITE OAK

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SECTION 2 - ENGINEERING DATA

2.1 Design: The design data reviewed was obtained from the SCS and included the following:

1) As-built drawings by the SCS indicating plans, elevations, and sections of the dam and appurtenant structures. Logs of test borings and test pits were also included in the as-built drawings (Appendix I).

2) Design report by the SCS including geologic and soil data, laboratory test results, hydrologic and hydraulic calculations, and structural design calculations. Stability analyses and geologic reports are included in Appendices VI and VII, respectively. Hydrology and hydraulic design data are discussed in more detail in paragraphs 5.1 and 5.8.

3) Annual operation and maintenance inspection reports for the past 3 years (Appendix V).

All existing data have been filed with the Norfolk District for future reference.

2.2 Construction: The dam; constructed by Moore, Kelly and Reddish, Inc.; was completed in 1965. Construction records were not available for this inspection; however, as-built drawings were reviewed and were subsequently verified in the field. Construction reports are on file in Washington, District of Columbia.

2.3 Operation: There are no formal operating procedures for this dam. In June 1972, the local SCS office reported that a flood peaked at approximately a 6 inch depth in the emergency spillway (combined discharge of principal and emergency spillway therefore was 250 c.f.s.).

2.4 Evaluation:

2.4.1 Design: The as-built drawings and design report were adequate to assess all aspects of design except slope stability. The slope stability calculations appear to be inconsistent, and the berms recommended in the calculations were not constructed (see Section 6). The omission of berms was not explained in the SCS Design Report. The hydrologic and hydraulic data provided was adequate for design review. The assessments made in this report are based on this design data along with field observations.

NAME OF DAM: WHITE OAK
2.4.2 Construction: No construction logs were available for review. However, as-built drawings indicate modifications and changes made during construction.

2.4.3 Operation: Annual operation and maintenance inspection reports were available for review (see Appendix V).
SECTION 3 - VISUAL INSPECTION

3.1 Findings

3.1.1 General: White Oak Dam was inspected on 28 November 1978. No unusual weather conditions were experienced, and the lake was at normal pool elevation. The dam and appurtenant structures were found to be in good overall condition at the time of inspection. The problems noted during the visual inspection were not considered to be serious and do not require immediate remedial treatment.

3.1.2 Dam: No serious deficiencies were observed which affect the stability of the dam. Clear flow from three 6 inch B.C.C.M.P. drains (see Photo 3), which collect water from the seepage drain, was measured at 0.0 g.p.m., 0.1 g.p.m., and 0.4 g.p.m. in the vicinity of the outlet of the principal spillway. Small trees and bushes have grown in several areas of the embankment including the slope gutters at the left abutment. A small animal burrow is located in the right downstream slope. Some small trees are growing on the right of the cut slope of the emergency spillway.

3.1.3 Appurtenant Structures: No signs of significant deterioration were observed in the structures. The concrete surfaces on the riser and exposed portion of the outlet pipe were in good condition.

3.1.4 Reservoir Area: No serious deficiencies were observed in the reservoir area (see Photo 1). However, some wood debris near the left shoreline of the dam was observed.

3.1.5 Downstream Channel: The stilling basin (see Photo 2) and outlet channel are functioning properly, and the riprap is generally in good overall condition. A slide-erosion area 20 feet wide by 18 feet high (see bottom of Photo 4) occurs on the right of the stilling basin approximately 30 feet from the toe of the dam. The slide-erosion area has displaced some riprap.

NAME OF DAM: WHITE OAK
3.2 Evaluation: None of the above items are considered to be serious, but the wood debris should be removed and the animal burrow should be filled in and seeded. The slide in the cut slope for the stilling basin has not impaired the use of the basin and is apparently not active. Periodic inspection of the slide area is advised. A staff gage should be installed to monitor reservoir levels above normal pool.
SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures: Operational procedures are generally discussed in paragraph 1.2.8. Water supply for the Town of Madison is supplemented during periods of low flow in White Oak Run by releases from the dam. According to the annual operation and maintenance inspection reports (see Appendix V), the four water supply gate valves were successfully opened and closed during the 1977 inspection. The reservoir drain is not operated periodically to check for proper functioning. Annual operation and maintenance inspections are conducted by the Town of Madison with the assistance of the Culpeper Soil and Water Conservation District and the regional SCS office.

4.2 Maintenance of Dam: Maintenance of the dam is provided by the Town of Madison, Virginia.

4.3 Maintenance of Operating Facilities: Maintenance of the water supply valves and reservoir drain is provided by the Town of Madison. The water supply valves were operated successfully in 1977.

4.4 Warning System: At the present time, there is no formal warning system or evacuation plan in operation. However, the dam and reservoir are checked during periods of intense rainfall.

4.5 Evaluation: Considering the functions served by the operational facilities, maintenance is considered adequate.

NAME OF DAM: WHITE OAK
SECTION 5 - HYDRAULIC/HYDROLOGIC DATA

5.1 **Design:** Normal pool (elevation 581.3 feet M.S.L.) is controlled by two 25 inch high by 36 inch wide orifices (one each on the upstream and downstream sides of the riser). Normal pool was established at an elevation sufficient to store 500 acre-feet of water supply and the 50-year sediment accumulation. The riser crest was established at an elevation (586.5 feet M.S.L.) to store an additional 0.98 inches of flood runoff. The capacity (198 c.f.s. with the reservoir level at the emergency spillway crest) of the principal spillway was established by consideration of a number of factors including:

1) The capability of evacuating the flood storage space within a reasonable time (less than 10 days).
2) Not passing damaging floods downstream.
3) The capability of the reservoir to store the floodwaters.

The crest (elevation 592.0 feet M.S.L.) of the emergency spillway was established at the elevation needed to store the 100-year, 10-day rainfall. The elevation of the top of dam (603.8 feet M.S.L.) was established by the maximum elevation reached in passing the freeboard hydrograph. The freeboard hydrograph was developed for a class "b" structure and was obtained by using $1.75 \times 6$ hour point rainfall and moisture condition II. This produced a 6 hour storm rainfall of 20.5 inches.

5.2 **Hydrologic Records:** No rainfall or stream flow records were available at the dam site.

5.3 **Flood Experience:** No exact high water marks were available. However, the local SCS office indicated that the June 1972 flood peak was flowing approximately 6 inches deep in the emergency spillway. Therefore, the discharge from the dam (including the principal spillway) was estimated at approximately 250 c.f.s.

5.4 **Flood Potential:** Performance of the reservoir by routing the Probable Maximum Flood (PMF), the 1/2 PMF, and the 100-year flood is shown in Table 5.1.

Outlet discharge capacity, and reservoir area and storage capacity were taken from the design report by the SCS. Hydrograph data and routing computations were
calculated as part of this report. Flood routings were begun with the reservoir level at normal pool.

5.5 Reservoir Regulation: Pertinent dam and reservoir data are shown in Table 1.1, paragraph 1.3.3.

Except for water supply, regulation of flow from the reservoir is automatic. Normal flow is maintained by the orifice openings at elevation 581.3 feet M.S.L. and the drop-inlet on the riser crest at elevation 586.5 feet M.S.L. Water entering these inlets flows through the dam in a 36 inch diameter reinforced concrete conduit. Water also flows past the dam through an un gated, vegetated, side-channel, emergency spillway in the event water in the reservoir rises above the spillway crest (elevation 592.0 feet M.S.L.).

5.6 Overtopping Potential: The probable rise in reservoir and other pertinent information on the reservoir performance in various hydrographs are shown in the following Table:

<table>
<thead>
<tr>
<th>TABLE 5.1 RESERVOIR PERFORMANCE</th>
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<tbody>
<tr>
<td>Item</td>
</tr>
<tr>
<td>Peak flow, c.f.s.</td>
</tr>
<tr>
<td>Inflow</td>
</tr>
<tr>
<td>Outflow</td>
</tr>
<tr>
<td>Peak elev., ft., M.S.L.</td>
</tr>
<tr>
<td>Emergency spillway</td>
</tr>
<tr>
<td>Depth of flow, ft. (a)</td>
</tr>
<tr>
<td>Avg. velocity, f.p.s.</td>
</tr>
<tr>
<td>Duration of flow, hrs.</td>
</tr>
<tr>
<td>Non-overflow section</td>
</tr>
<tr>
<td>Depth of flow, ft.</td>
</tr>
<tr>
<td>Average velocity, f.p.s.</td>
</tr>
<tr>
<td>Duration of overtopping, hrs.</td>
</tr>
<tr>
<td>Tailwater elev., ft., M.S.L.</td>
</tr>
</tbody>
</table>

(a) Depth at control section, not including velocity head.

5.7 Reservoir Emptying Potential: The time for the reservoir to empty from the emergency spillway crest (discharge of 198 c.f.s.) to normal pool is about 7 days, according to the SCS calculations. The drawdown time from normal pool to the reservoir bottom (drain invert of 547.0 feet M.S.L.) is approximately 3 days.

NAME OF DAM: WHITE OAK

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5.8 Evaluation: White Oak Dam was designed by the SCS as a class "b" structure with point rainfall of 22.75 inches yielding an areal rainfall of 20.5 inches for the freeboard hydrograph. According to the COE criteria, the dam is classified as a "high" hazard-"intermediate" size structure which should pass a spillway design flood essentially equal to the PMF. The dam was evaluated by using a Probable Maximum Precipitation (PMP) of 27.2 inches. The PMF was routed through the reservoir and produced a maximum water surface elevation of 606.3 feet M.S.L. which would overtop the dam by 2.5 feet. The spillway will only pass 67 percent of the PMF.

Conclusions pertain to present day conditions and the effect of future development on the hydrology has not been considered.
SECTION 6 - DAM STABILITY

6.1 Foundation and Abutments: There is 5 to 10 feet of alluvial, silty sand with gravel overlying hard, coarse-grained granite with gneissic structure which dips at 70° in the bottom of the valley. Minor joints are vertical. The bedrock is in the Lovingston Formation of the Blue Ridge complex. The cutoff trench was excavated into the top of firm bedrock and back filled with clay and silt for seepage control.

Approximately 5 feet of brown, damp sand and silt with rock fragments overlies hard granite in the abutment areas. The granite dips at 60°SW with a strike N40°-50°E in the cut of the emergency spillway.

6.2 Stability Analysis

6.2.1 Visual Observations: No evidence of instability in the embankment slopes, spillway cut slopes or concrete structures was observed. A small slide has occurred in the cut for the stilling basin on the right side, 30 feet downstream from the toe of the dam. Minor flow was measured from two outlet pipes collecting water from the seepage drain. No evidence of serious damage was observed from high water.

6.2.2 Design Data: Available design data appears to represent stability calculations performed on two occasions. The first design set accompanies an SCS office memorandum dated 17 July 1963. The second design set accompanies calculations done in March 1964.

1963: Slope stability was checked by both the Sliding Wedge Method and a modification of the Swedish Circle Method. A sliding wedge analysis was used because of the possibility of a shallow foundation failure. The zoned embankment sections chosen for these analyses showed the shell of the dam adjacent to the impervious core with slope ratios of 1 horizontal to 1 vertical (1:1). Side slopes of the dam were indicated as 2.5:1 over 3:1 on the upstream side and 2.5:1 on the downstream side. The following shear strength parameters were used for the foundation and embankment soils:

NAME OF DAM: WHITE OAK
The shear strength of the soils was determined from remolded samples compacted at 95% of standard density. The samples were saturated and subjected to consolidated, undrained, triaxial shear tests.

Minimum safety factors computed were 1.37 for the upstream slope under full drawdown at Station 7+00 and 1.12 at Station 6+57. Addition of a 26 foot berm at elevation 566.0 feet M.S.L. would increase the factor of safety to 1.34.

The Swedish Circle Method of analysis resulted in a factor of safety of 1.15 for the same conditions with a 5 foot thick foundation. It was determined that a 28 foot berm at elevation 566.0 feet M.S.L. was required to raise the factor of safety to 1.50.

1964: No memorandum accompanies these calculations and they appear to be incomplete. Table 6.1 summarizes the calculations found in Appendix VI.

The calculations indicate that the upstream safety factor would be increased if the foundation soil was replaced with a higher strength material. The downstream safety factor was 1.41 with the foundation soil in place and no berms. This result conflicts with the calculations done in 1963.

---

* From strength tests.
** Estimated by SCS.

NAME OF DAM: WHITE OAK

20
<table>
<thead>
<tr>
<th>CONDITION</th>
<th>ELEVATION (feet M.S.L.)</th>
<th>SLOPE</th>
<th>TYPE OF ANALYSIS</th>
<th>( \theta )</th>
<th>C (p.s.f.)</th>
<th>SAFETY FACTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundation Soil Not Excavated</td>
<td>592.0</td>
<td>U/S</td>
<td>Circular</td>
<td>Emb. 31.5</td>
<td>300</td>
<td>1.26</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Arc</td>
<td>Fdn. 25</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Foundation Soil Excavated</td>
<td>592.0</td>
<td>U/S</td>
<td>Circular</td>
<td>Emb. 18.5</td>
<td>0</td>
<td>1.44</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Arc</td>
<td>Fdn. 18.0</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>Foundation Soil Not Excavated</td>
<td>592.0</td>
<td>U/S</td>
<td>Wedge</td>
<td>Emb. 18.5</td>
<td>500</td>
<td>1.57</td>
</tr>
<tr>
<td></td>
<td>*</td>
<td>D/S</td>
<td>Circular</td>
<td>Emb. 31.5</td>
<td>300</td>
<td>1.41</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Arc</td>
<td>Emb. 33.5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fdn. 25</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

U/S - Upstream
D/S - Downstream

* Pool elevation not given.

NAME OF DAM: WHITE OAK
The as-built conditions are similar to the embankment sections used in the stability analyses. However, the 26 foot wide berm on the upstream side and the 28 foot wide berm on the downstream side, which were required to raise the factors of safety to acceptable levels, were not constructed. The as-built drawings also show that the foundation soil was not removed and replaced with compacted material.

6.2.3 Operating Records: With the exceptions of encroaching brush and trees in several areas, the yearly inspection reports indicate that no seriously deteriorating conditions have developed. Heavy brush has apparently been removed in the emergency spillway, but some small trees still remain in other areas.

6.2.4 Post-Construction Changes: No alterations of the dam were apparent since its construction.

6.2.5 Seismic Stability: White Oak Dam is in Seismic Zone 2 and is considered to have no hazard from earthquakes according to the Recommended Guidelines for Safety Inspection of Dams, provided static stability conditions are satisfactory and conventional safety margins exist.

6.3 Evaluation: The additional berms on the upstream slope (26 feet wide) and on the downstream slope (28 feet wide) required to raise the factor of safety to 1.50 were not constructed.

The design and as-built drawings indicated that foundation soils were not removed outside of the cutoff trench area. Because the embankment stability analyses demonstrated the need for either the addition of berms (which were not built) or the removal of foundation soil (which was not excavated), it is recommended that the stability of the embankment and the soil strengths be further examined to confirm the necessity of the originally recommended measures.

NAME OF DAM: WHITE OAK

22
SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment: The discharge capacity of White Oak Dam is insufficient to pass the PMF which is the spillway design flood (according to "intermediate" size-"high" hazard classification). The spillway will pass approximately 67 percent of the PMF. Therefore, the spillway is inadequate but not seriously inadequate.

The slide-erosion area at the end of the emergency spillway on the right bank of the stilling basin (which could have resulted from flow in the emergency spillway in June of 1972) does not show signs of recent movement or erosion. There does not appear to be a need for additional riprap protection at this time; however, the area should be checked during the annual inspections.

The data available was sufficient to evaluate the adequacy of design. As-built drawings and the visual inspection of the dam indicate no serious departure from design plans. However, berms and foundation soil excavation that were recommended during the design stage were not included during final design and construction. It is recommended that the stability of the embankment be re-examined.

The dam will not require urgent remedial treatment.

7.2 Recommended Remedial Measures: The inspection revealed certain preventative maintenance items which should be scheduled during the annual operation and maintenance inspections. These are:

1) Remove small trees and brush on the embankment.
2) Remove debris in the reservoir area.
3) Excavate and fill animal burrows on the embankment.
4) Install a staff gage to monitor reservoir levels above normal pool.

NAME OF DAM: WHITE OAK
APPENDIX I

PLATES
CONTENTS

Location Plan
Plate 1: Plan - Profile of Dam
Plate 2: Typical Sections
Plate 3: Plan-Profile of Principal Spillway

NAME OF DAM: WHITE OAK
LOCATION PLAN

WHITE OAK DAM
APPENDIX II

PHOTOGRAPHS
CONTENTS

Photo 1: Reservoir Area, Riser, and Walkway
Photo 2: Concrete Outlet Pipe and Stilling Basin
Photo 3: Seepage Drain (6 Inch Outlet Pipe)
Photo 4: Outlet Channel for Emergency Spillway

Note: Photographs were taken on 28 November 1978.

NAME OF DAM: WHITE OAK
WHITE OAK DAM

PHOTO 1. Reservoir Area, Riser and Walkway

PHOTO 2. Concrete Outlet Pipe and Stilling Basin
PHOTO 3. Seepage Drain (6-Inch Outlet Pipe)

PHOTO 4. Outlet Channel for Emergency Spillway
APPENDIX III

CHECK LIST - VISUAL INSPECTION
Check List
Visual Inspection
Phase 1

Name of Dam White Oak County Madison State Virginia Coordinates Lat. 38°22.8
Long. 78°18.6

Date Inspection 28 November 1978 Weather Warm, Clear Temperature 55°F.

Pool Elevation at Time of Inspection 581.7 ft. M.S.L. Tailwater at Time of Inspection 539.1 ft. M.S.L.

Inspection Personnel: Michael Baker, Jr., Inc.: Virginia Water Control Board:
T. W. Smith
W. L. Shearer
T. J. Dougan
Roy Murphy
Tim Perry

T. W. Smith Recorder
<table>
<thead>
<tr>
<th>EMBANKMENT</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of Dam: <em>WHITE OAK</em></td>
<td></td>
</tr>
<tr>
<td>VISUAL EXAMINATION OF</td>
<td>OBSERVATIONS</td>
</tr>
<tr>
<td>SURFACE CRACKS</td>
<td>None observed.</td>
</tr>
<tr>
<td>UNUSUAL MOVEMENT OR</td>
<td>None observed.</td>
</tr>
<tr>
<td>CRACKING AT OR BEYOND</td>
<td></td>
</tr>
<tr>
<td>THE TOE</td>
<td></td>
</tr>
<tr>
<td>SLOUGHING OR EROSION OF</td>
<td>There is evidence of sloughing or erosion of the</td>
</tr>
<tr>
<td>EMBANKMENT AND ABUTMENT</td>
<td>dam and abutment slopes.</td>
</tr>
<tr>
<td>SLOPES</td>
<td></td>
</tr>
<tr>
<td>VERTICAL AND HORIZONTAL</td>
<td>Good</td>
</tr>
<tr>
<td>ALIGNMENT OF THE CREST</td>
<td></td>
</tr>
<tr>
<td>RIPRAP FAILURES</td>
<td>No failures were observed in the stone riprap at the</td>
</tr>
<tr>
<td>normal pool on the upstream slope.</td>
<td></td>
</tr>
<tr>
<td>SLOPES</td>
<td>The downstream slope and the upper portion of the upstream</td>
</tr>
<tr>
<td></td>
<td>slope were constructed at a 2.5:1 ratio. The upstream slope</td>
</tr>
<tr>
<td></td>
<td>below the 10 ft. berm beneath the normal pool elevation</td>
</tr>
<tr>
<td></td>
<td>has a 3:1 ratio. The slope has thick vegetation with some</td>
</tr>
<tr>
<td></td>
<td>small trees. Driftwood is deposited on the left abutment</td>
</tr>
<tr>
<td></td>
<td>near the lake shoreline.</td>
</tr>
</tbody>
</table>
### EMBANKMENT

**Name of Dam:** WHITE OAK  

<table>
<thead>
<tr>
<th>VISUAL EXAMINATION OF</th>
<th>OBSERVATIONS</th>
<th>REMARKS OR RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTRUCTION MATERIALS</td>
<td>The dam was constructed in 3 zones according to the plans: 1) silt and clay core, 2) silt and clay on upstream portion and upper part of the downstream slope, and 3) silty sand on lower part of downstream area. The surface soil was firmly compacted brown, damp, sandy silt with small rock fragments. There is a small animal burrow in the lower part of the downstream slope on the right abutment. The downstream toe is rock.</td>
<td>The burrow should be excavated, filled, and seeded.</td>
</tr>
</tbody>
</table>

| JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM | There is brown, damp sand and silt with traces of rock fragments at the left abutment slope. The bedrock consists of hard granite, alaskite, and greisen. Granite with a 70° dipping gneissic structure is exposed in the emergency spillway near the right abutment with silty sand and some rock fragments above the bedrock. Some small trees and bushes were observed in the unpaved slope gutters at the left abutment. | The trees and bushes in the slope gutters should be removed. |

| ANY NOTICEABLE SEEPAGE | No seepage from the embankment of the dam was observed. A small, clear seep (15 x 20 ft.) was observed in the saturated silty sand at the base of the left abutment 50 ft. downstream from the dam. | Install a staff gage to monitor reservoir levels above normal pool. |

| STAFF GAGE AND RECORDER | None | Install a staff gage to monitor reservoir levels above normal pool. |

| DRAINS | There are 3 - 6 in. B.C.C.M.P. drains (see photo 3) in the vicinity of the outlet of the principal spillway pipe which remove water from the seepage drain. The pipe on the far left had a flow of 0.4 g.p.m. of clear water. The drain adjacent to the outlet pipe on the left was measured at 1/8 g.p.m. The pipe on the right side was dry. |
Name of Dam: **WHITE OAK**

<table>
<thead>
<tr>
<th>VISUAL EXAMINATION OF</th>
<th>OBSERVATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOUNDATION</td>
<td>The foundation is brown, silty sand with gravel above</td>
</tr>
<tr>
<td></td>
<td>weathered to hard granite with gneissic structure</td>
</tr>
<tr>
<td></td>
<td>dipping at 70° according to the test borings shown</td>
</tr>
<tr>
<td></td>
<td>in the plans. The joints are steep. The bedrock is</td>
</tr>
<tr>
<td></td>
<td>of the Lovingston Formation, Blue Ridge complex. The</td>
</tr>
<tr>
<td></td>
<td>cutoff trench is excavated to the top of the firm bedrock.</td>
</tr>
</tbody>
</table>

---
### OUTLET WORKS

Name of Dam: **WHITE OAK**

<table>
<thead>
<tr>
<th>VISUAL EXAMINATION OF</th>
<th>OBSERVATIONS</th>
<th>REMARKS OR RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT</td>
<td>Outlet conduit is in good condition (no visual spalling or cracking), and the concrete cradle under the pipe is well supported.</td>
<td></td>
</tr>
<tr>
<td>INTAKE STRUCTURE</td>
<td>The intake structure is a R.C. riser with normal pool controlled by 2 orifice inlets (25 in. high by 36 in. wide at elevation 581.3 ft. M.S.L.). Riser crest is at elevation 586.5 ft. M.S.L. and has 2 intakes, 1 on each side of riser with each having an overflow weir length of 9 ft. A 36 in. reservoir drain is located at elevation 547.0 ft. M.S.L.</td>
<td></td>
</tr>
<tr>
<td>OUTLET STRUCTURE</td>
<td>The flow in the 36 in. diameter R.C.P. was measured at a depth of 5 in. The pipe empties into a stilling basin approximately 40 ft. wide and 60 ft. long with stone riprap protection. Photo 2 shows the outlet pipe and stilling basin.</td>
<td></td>
</tr>
<tr>
<td>OUTLET CHANNEL</td>
<td>From the stilling basin, the water flows into a well-defined channel downstream for about 100 to 200 ft. The overbanks are highly brush covered. About 200 ft. downstream, the stream channel becomes deeper as it enters a wooded area.</td>
<td></td>
</tr>
<tr>
<td>EMERGENCY GATE</td>
<td>The emergency gate is a 36 in. slide gate which can be used to drain the reservoir.</td>
<td></td>
</tr>
<tr>
<td>STILLING BASIN</td>
<td>There is a slide in the cut in the hillside into the stilling basin about 30 ft. from the outlet of the principal spillway in silt, gravel, cobbles, and boulders. Some of the riprap has slid into the stilling basin, but there is generally a good riprap coverage of the basin. There is vegetation on the slide providing some protection. The sloughing in a 20 ft. wide x 18 ft. maximum height area was caused by the stream undercutting the slope on the right side during a high water stage. There is no blockage in the basin.</td>
<td></td>
</tr>
</tbody>
</table>
UNGATED SPILLWAY

Name of Dam: WHITE OAK

<table>
<thead>
<tr>
<th>VISUAL EXAMINATION OF</th>
<th>OBSERVATIONS</th>
<th>REMARKS OR RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONCRETE WEIR</td>
<td>None</td>
<td></td>
</tr>
<tr>
<td>APPROACH CHANNEL</td>
<td>Large rocks were placed at the approach on the bank of the reservoir. The soil is sandy silt and rock fragments above the hard granite bedrock. There is a good growth of vegetation on the soil. The emergency spillway has a 2% adverse slope to the level control section 30 ft. wide.</td>
<td></td>
</tr>
<tr>
<td>DISCHARGE CHANNEL</td>
<td>The deepest portion of the cut for the channel is in hard granite with gneissic structure and covered with sandy silt to foster growth of grass. The outlet area is in sandy silt with little to some rock fragments. There is a grass cover. A small drainage ditch has been cut across the lower end and outlets into the stream in the woods. The exit channel has a positive slope of 16%. Photo 4 shows the discharge channel.</td>
<td></td>
</tr>
<tr>
<td>BRIDGE AND PIERS</td>
<td>A steel catwalk, about 2.5 ft. wide and supported by four concrete piers, provides access to the riser.</td>
<td></td>
</tr>
<tr>
<td>CUT SLOPES</td>
<td>The middle of the cut is in soft to hard granite with gneissic structure. The dip of the structure varies from 20° to 40° in a downstream direction. Steep joints have caused uneven breakage and some talus. The limits of the cut and the upper part above the bedrock are in brown sand and silt with little to some rock fragments and gravel at a 3:1 ratio. The slopes are well-covered with grass and some small trees.</td>
<td></td>
</tr>
<tr>
<td>INSTRUMENTATION</td>
<td>OBSERVATIONS</td>
<td>REMARKS OR RECOMMENDATIONS</td>
</tr>
<tr>
<td>----------------</td>
<td>-------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>WHITE OAK</td>
<td>None observed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td>None</td>
<td></td>
</tr>
<tr>
<td></td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

III-7
**Name of Dam:** WHITE OAK

<table>
<thead>
<tr>
<th>VISUAL EXAMINATION OF</th>
<th>OBSERVATIONS</th>
<th>REMARKS OR RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SLOPES</td>
<td>The ratio of the slopes ranges from gentle to moderately steep with woods and open areas in the vicinity of the cottages. There are boat docks and other recreational facilities. The soils consist of silt, sand, and variable quantities of rock fragments. Clayey silt is present in some areas. There are scattered exposures of bedrock. Photo 1 shows the reservoir area.</td>
<td></td>
</tr>
<tr>
<td>SEDIMENTATION</td>
<td>No unusual sedimentation was noted around the riser and upstream embankment. However, local residents stated that sedimentation at the upstream end of the reservoir is occurring.</td>
<td></td>
</tr>
</tbody>
</table>
### Name of Dam: WHITE OAK

#### DOWNSTREAM CHANNEL

<table>
<thead>
<tr>
<th>VISUAL EXAMINATION OF</th>
<th>OBSERVATIONS</th>
<th>REMARKS OR RECOMMENDATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)</td>
<td>There are no obstructions or debris. The channel deepens and widens downstream as it enters the woods.</td>
<td></td>
</tr>
<tr>
<td>SLOPES</td>
<td>The slopes are cut in brown, silty sand, gravel, cobbles, and small boulders and are stable. The channel slope is approximately 1% immediately downstream from the stilling basin.</td>
<td></td>
</tr>
<tr>
<td>APPROXIMATE NO. OF HOMES AND POPULATION</td>
<td>There are a few scattered farms located downstream of the dam. Approximately 4 miles downstream is the Town of Madison with a population of 500.</td>
<td></td>
</tr>
</tbody>
</table>
CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

Name of Dam: WHITE OAK

<table>
<thead>
<tr>
<th>ITEM</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLAN OF DAM</td>
<td>A Plan of Dam, as contained in the as-built drawings, is included in this report as Plate 1.</td>
</tr>
<tr>
<td>REGIONAL VICINITY MAP</td>
<td>is included in this report as Location Plan.</td>
</tr>
<tr>
<td>CONSTRUCTION HISTORY</td>
<td>was obtained from the SCS. The contractor was Moore, Kelly and Reddish, Inc. The dam construction was completed in 1965.</td>
</tr>
<tr>
<td>TYPICAL SECTIONS OF DAM</td>
<td>as contained in the as-built drawings are included in this report as Plates 2 and 3.</td>
</tr>
<tr>
<td>HYDROLOGIC/HYDRAULIC DATA</td>
<td>is included in the SCS Design Report.</td>
</tr>
<tr>
<td>OUTLETS</td>
<td>PLAN and DETAILS contained in the as-built drawings.</td>
</tr>
<tr>
<td></td>
<td>CONSTRAINTS and DISCHARGE RATINGS contained in the SCS Design Report.</td>
</tr>
<tr>
<td>RAINFALL/RESERVOIR RECORDS</td>
<td>None available at dam site.</td>
</tr>
</tbody>
</table>
Name of Dam: WHITE OAK

<table>
<thead>
<tr>
<th>ITEM</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESIGN REPORTS</td>
<td>The SCS Design Report was available for this study.</td>
</tr>
<tr>
<td>GEOLOGY REPORTS</td>
<td>The SCS Design Report contains the results of the soil and geologic studies.</td>
</tr>
<tr>
<td>DESIGN COMPUTATIONS</td>
<td>Hydrology and hydraulic calculations, stability analyses of the dam, and results of water pressure testing are contained in the SCS Design Report. The water pressure tests are also shown in the plans.</td>
</tr>
<tr>
<td>HYDROLOGY &amp; HYDRAULICS</td>
<td></td>
</tr>
<tr>
<td>DAM STABILITY</td>
<td></td>
</tr>
<tr>
<td>SEEPAE STUDIES</td>
<td></td>
</tr>
<tr>
<td>MATERIALS INVESTIGATIONS</td>
<td>Records of test pits and borings are presented in the as-built drawings. Laboratory test results and soil classifications are included in the Design Report.</td>
</tr>
<tr>
<td>BORING RECORDS</td>
<td></td>
</tr>
<tr>
<td>LABORATORY</td>
<td></td>
</tr>
<tr>
<td>FIELD</td>
<td></td>
</tr>
<tr>
<td>POST-CONSTRUCTION SURVEYS OF DAM</td>
<td>None known.</td>
</tr>
<tr>
<td>BORROW SOURCES</td>
<td>Borrow areas are shown on the as-built drawings.</td>
</tr>
</tbody>
</table>
Name of Dam:   WHITE OAK

<table>
<thead>
<tr>
<th>ITEM</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MONITORING SYSTEMS</td>
<td>No monitoring systems other than the spillway riser were designed into dam.</td>
</tr>
<tr>
<td>MODIFICATIONS</td>
<td>Field conditions were found to verify the as-built drawings indicating no major modifications were made to the dam.</td>
</tr>
<tr>
<td>HIGH POOL RECORDS</td>
<td>Water was approximately 0.5 ft. deep in the emergency spillway during the June 1972 flood.</td>
</tr>
<tr>
<td>POST-CONSTRUCTION ENGINEERING</td>
<td>Other than annual inspections, no known post-construction engineering studies or reports have been completed.</td>
</tr>
<tr>
<td>STUDIES AND REPORTS</td>
<td></td>
</tr>
<tr>
<td>PRIOR ACCIDENTS OR FAILURE OF DAM</td>
<td>None</td>
</tr>
<tr>
<td>DESCRIPTION REPORTS</td>
<td></td>
</tr>
<tr>
<td>MAINTENANCE OPERATION RECORDS</td>
<td>Annual inspections are conducted by the Town of Madison with the assistance of the SCS and the Culpeper Soil and Water Conservation District.</td>
</tr>
</tbody>
</table>
Name of Dam: **WHITE OAK**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPILLWAY PLAN.</td>
<td></td>
</tr>
<tr>
<td>SECTIONS, and DETAILS</td>
<td>are contained in the as-built drawings.</td>
</tr>
<tr>
<td>OPERATING EQUIPMENT plans &amp; details</td>
<td>Shown in the as-built drawings and consist of crank operated lifts with pedestal base (4 for future water supply and 1 for the reservoir drain).</td>
</tr>
</tbody>
</table>
CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 5.06 sq.mi.

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 581.3 ft. M.S.L.

ELEVATION OF EMERGENCY SPILLWAY CREST (STORAGE CAPACITY): 592.0 ft. M.S.L. (1250 ac.-ft.)

ELEVATION MAXIMUM DESIGN POOL: 600.4 ft. M.S.L.

ELEVATION TOP DAM: 603.8 ft M.S.L. (settled)

CREST: Emergency Spillway

a. Elevation 592.0 ft. M.S.L.
b. Type Earth, side-channel with vegetative cover
c. Width 75 ft.
d. Length Total length 340 ft. (approach 100 ft., level section 30 ft., exit 210 ft.)
e. Location Spillover Outside right abutment
f. Number and Type of Gates Not Applicable

OUTLET WORKS:

a. Type Drop-inlet reinforced concrete riser
b. Location Riser in reservoir with 36 in. R.C.P. exiting into stilling basin
c. Entrance Inverts 581.3 ft. M.S.L. (normal pool)
d. Exit inverts 586.5 ft. M.S.L. (riser crest)
e. Emergency draindown facilities 36 in. reservoir drain with invert at 547.0 ft. M.S.L.

HYDROMETEOROLOGICAL GAGES: Not available

a. Type ____________________________________________
b. Location __________________________________________
c. Records __________________________________________

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

Name of Dam: WHITE OAK

IV-5
APPENDIX V

OPERATION AND MAINTENANCE INSPECTION REPORTS
White Oak Watershed
Annual Inspection

In compliance with policies and procedures outlined in MS Memo-Va-17, April 14, 1972, the annual inspection of the multi-purpose flood control and water storage structure designated as Site#1 of the White Oak Run Watershed in Madison County, Virginia was made on June 9, 1976. Assisting in the inspection were Madison Mayor Joe Drake; Harry Shepherd, Madison Filtration plant employee; James F. Grove, L. W. Kipps, H. S. Barksdale, and Mrs. Elizabeth Weaver, Culpeper S. W. C. D. Directors. Also, James Blair of the State Soil and Water Conservation Commission; Richard Reed and Garland Kidd of the Soil Conservation Service.

All items called for in the operations and maintenance agreement were inspected and the following observations and agreements were made:

1. Considerable brush is growing at the entrance to the emergency spillway and along the waterline of dam also miscellaneous brush is growing in emergency spillway and on both front and back side of dam. The Madison town council agreed to cut this brush.

2. On the back side of dam some areas are reverting to native vegetation, but all vegetation on dam and spillway is performing a good job of protecting areas from erosion.

3. Some rust spots are appearing on the metal railing of walk way leading to principal spillway. The town of Madison agreed to perform the needed paint work.

4. None of the four gate valves, that were installed for release of municipal water have been operated since they were installed in 1965. The District Directors recommended that the Town open and close these gate valves periodically. (once or twice a year)

This practice should improve the operation of these valves when needed to release water for municipal use.

S. W. C. D. Director

Mayor Town of Madison

Soil Conservation Service
OPERATION & MAINTENANCE INSPECTION REPORT

Submitted: White Oak Run Watershed 1 Site

Inspected by: L. W. Kidd, SHED Director Date: April 25, 1977

Jim Hodge, Bob; Harry Shepherd, Town of Madison

1. Describe any erosion which needs corrective action.

2. Describe condition of vegetation cover. Identify required action.
Small areas of honeysuckle are starting on several spots of the dam, which is crowding out the Kentucky 31 fescue. This honeysuckle will be cut or otherwise suppressed to prevent further encroachment on the Kentucky 31 fescue. Phosphate and potash will be maintained at a median level and the pH between 5.3 and 6.3. The Town of Madison will do the needed work.

3. Describe woody vegetation on or near the embankment. Identify needed action.

Miscellaneous brush on the dam and in the spillway will be cut. The Town of Madison will do this work.

4. Condition of principal spillway inlet and outlet and foundation
   drain outlets. Identify needed action.

Principal spillway, inlet and outlet and foundation drains were in good condition and functioning. Small spots of rust are occurring on the guard rails and catwalk. These spots will be cleaned and painted by the Town of Madison.

Corrective action taken, date and cost.

The 1976 inspection report indicated that brush was to be removed from entrance to emergency spillway and other parts of dam. This brush has been cut.

The Town opened and closed the four gate valves satisfactorily as recommended in 1976 inspection report.

[Signatures]

V-2
OPERATION & MAINTENANCE INSPECTION REPORT

Submitted: White Oak Run Watershed: No. 1 Site

Inspected by: Overton Weaver, SWCD Director Date: May 18, 1975
Garland J. Kidd, SCS Stewart Miller, Town of Madison
James F. Blodgett, SCS E. Forrest Lohr

1. Describe any erosion which needs corrective action.

NONE

2. Describe condition of vegetation cover. Identify required action.
Kentucky #31 fescue and miscellaneous low growing vegetation provide sufficient cover for erosion control.

3. Describe woody vegetation on or near the embankment. Identify needed action.
Miscellaneous brush or woody growth is encroaching on more desirable type low growing vegetation on front and back side of Dam and at entrance to flood spillway. The Town of Madison will suppress or remove this brush.


Above mentioned facilities are in good condition and functioning as intended.

Corrective action taken, date and cost.

The four gate valves were opened and closed by the Town of Madison during 1977. The Town may want to consider doing this periodically to ascertain operability.

Garland J. Kidd
Garland J. Kidd
Soil Conservation Service

Mayor, Town of Madison

Overton Weaver
Director, Culpeper, SWCD
APPENDIX VI

STABILITY ANALYSIS
1963 STABILITY CALCULATIONS
VIRGINIA WP-08, WHITE OAK RUN, SITE NO. 1
STABILITY ANALYSIS PORTION RETYPED
STABILITY ANALYSIS:

The initial assumption of the stability analysis was that none of the less plastic and cohesionless soils would be utilized in the upstream slope. Unless otherwise specified, the analyses discussed were based on a modification of the Swedish Circle Method.

The first part of the analysis was based on Station 7+00, where the embankment will be 63.3 feet high. A complex upstream slope was analyzed: 2 1/2:1 slope above elevation 581.0, 10-foot berm at elevation 581.0 and 3:1 slope below elevation 581.0. It was assumed that failure would be limited to the embankment. The lowest factor of safety found was 1.37. This was based on the saturated shear parameters for Sample 63W3583 (CL) and assumed full drawdown. Study of this analysis led to the conclusion that the foundation would have to be considerably stronger than the embankment values used in order to resist failure. Therefore, additional foundation information was requested (Ref. 1). Density information obtained at the site, along with the gradation of Sample 63W3572, led to the assignment of shear parameters of $\phi = 25^\circ$ and $c = 100$ p.s.f. to the foundation.

The second part of the analysis was based on conditions at Station 6+57 with a 5-foot foundation having parameters of $\phi = 25^\circ$, $c = 100$ p.s.f. At Station 6+57 the dam will be 57.8 feet high. It was found that the 2 1/2:1/3:1 slope with a 10-foot berm at elevation 581.0 gave a factor of 1.12 against embankment-foundation failure. It was found that an additional 26-foot berm at elevation 566.0 was required to bring the factor of safety up to 1.34.

The downstream slope of the embankment was initially assumed to be 2 1/2:1 with a drain at $c = 0.6b$. Infinite slope analysis for a dry slope like Sample 63W3577 (non-plastic SM) gave a factor of safety of 1.65. Sliding Wedge analysis of the 2 1/2:1 slope sliding on the $25^\circ$-100 p.s.f. foundation gave a factor of safety equal to 1.97. Ordinarily, a factor greater than 2.0 is the minimum of acceptibility for the Sliding Wedge analysis. The Swedish Circle Method of analysis gave a factor equal to 1.15 for the 2 1/2:1 slope with a drain at $c = 0.6b$ and with a 5-foot "correlated" foundation. It was found that a 28-foot berm at elevation 566.0 is required to raise this factor of safety to 1.50.

RECOMMENDATIONS

A. Cutoff and Drainage: A positive cutoff is recommended. This will require penetration to sound bedrock. A wide trench bottom is recommended in the zone below the
normal pool to assure good bond with the bedrock. A bottom width of 20 feet should be adequate. During the excavation of the cutoff into the abutments, the bedrock should be carefully examined. Open seams and mud seams should be repaired with "dental grouting", so that the cutoff will not be exposed to flow. The cutoff should be backfilled with some of the more plastic materials compacted to 95 percent of Standard density.

Foundation drainage will not be required, since positive cutoff is to be provided. However, embankment drainage is required for stability and protection against piping. In the areas where there are seams, it is desirable to extend the embankment drain down to pick up the flow. This can be done with blind drain, if the seams are scattered and few. An attached Form SCS 353 shows the recommended filter limits. A thickness of at least 12 inches of filter should be used. The drain should be located at \( c = 0.6b \) and should extend to elevation 576.

B. Principal Spillway: The principal spillway location appears to be satisfactory. Total consolidation and maximum horizontal unit strain are expected to be quite low. Since the entire principal spillway has been trenched out with pits, it is recommended that the trench be cut with a 20-foot bottom on bedrock and with 2:1, or flatter, side slopes. This trench should be backfilled with some of the materials recommended for the upstream slope. The backfill should be compacted to at least 95 percent of Standard density with moisture contents very near optimum. It is recommended that a protective filter entirely surround the conduit at the drain line.

C. Embankment Design: There are three basic alternatives that are consistent with the data available and the analyses based on those data. Briefly, these alternatives are (1) remove and re-compact or replace the questionable alluvium from the floodplain and the abutment mantle up to approximately elevation 550, (2) provide extra berming (or flatter slopes) to raise the factor of safety to an allowable value, or (3) secure undisturbed samples of the questionable materials for shear testing, and base design on the strengths obtained. The specific recommendations for Alternates 1 and 2 are outlined more fully below.
1. **Slopes:**

Alternate 1 (Removal)

**Upstream:** 2 1/2:1 above elevation 581.3, 10-foot berm at elevation 581.3, 3:1 below elevation 581.3.

**Downstream:** 2 1/2:1; drain at c = 0.6b.

Alternate 2 (Extra Beming)

**Upstream:** 2 1/2:1 above elevation 581.3, 3:1 below elevation 581.3, 10-foot berm at elevation 581.3, 26-foot berm at elevation 566.0.

**Downstream:** 2 1/2:1 with a 28-foot berm at elevation 566.0; drain at c = 0.6b.

The remaining recommendations apply both to Alternates 1 and 2.

2. **Placement of Materials:** (See attached Form SCS 372.)

A plan of selective placement is recommended which utilizes more plastic, cohesive soils in the upstream slope and less plastic, low cohesion (in some cases cohesionless, free draining) materials in the downstream slope. It is extremely important to keep the soils with little or no cohesion out of the upstream slope, since drawdown would tend to cause surface failures in such materials. Placing the less plastic materials downstream will also help assure drawdown of the phreatic surface by the drain, thus guarding the downstream slope face against steady seepage. Since the stability analysis assumed this condition, it is also rather important. The plan of selective placement agrees, for the majority of the materials, with the plan recommended by the Geologist. The differences are based primarily on grain size distribution and plasticity considerations.
RETYPED ON VI-1 THROUGH VI-3

The point on each compression curve was run on material with the 'natural moisture content' (as received). A study of these results indicated that most materials except the final will probably require mixing. The 'natural moisture' point for 9 of the samples are densities below 95 percent of standard density. Several other samples contained moisture above that is felt a desirable upper placement limit.

C. Optimality: Tests of the materials under evaluation are expected to have the effect of permitting an estimate of percent. There are many materials evaluated, however, that require further low percentage of compressibility tests. These may be considered potentially.

D. Stress Test: The compressive undrained shear tests were performed on 2 1/2 ft deep samples. Stress test were approximately 35 percent of standard density. Additional results of these tests are calculated below. To in field tests three tests intergrally, keep the range of materials to be used and the test results are not used for design.

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Grade</th>
<th>C深知</th>
<th>D深知</th>
<th>E深知</th>
<th>F深知</th>
</tr>
</thead>
<tbody>
<tr>
<td>6192</td>
<td>204</td>
<td>204</td>
<td>204</td>
<td>204</td>
<td>204</td>
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<td>6193</td>
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<td>204</td>
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<tr>
<td>6194</td>
<td>204</td>
<td>204</td>
<td>204</td>
<td>204</td>
<td>204</td>
</tr>
<tr>
<td>6195</td>
<td>204</td>
<td>204</td>
<td>204</td>
<td>204</td>
<td>204</td>
</tr>
<tr>
<td>6196</td>
<td>204</td>
<td>204</td>
<td>204</td>
<td>204</td>
<td>204</td>
</tr>
</tbody>
</table>

E. Conclusions: It is anticipated that at the maximum stress, the dam will reach a point of the height after construction is complete. Due to consolidation of reasonable time, etc.

STATEMENT ATTACHED

The initial construction of the embankment analysis was that none of the downstream and embankment wall would be included in the upstream slope. Under otherwise special, the embankment discussed were based on a modification of the Swedish Circle Test 3.

The first part of the analysis was based on a Swedish Circle, where the embankment will be 9 1/4 feet high. A complete upstream slope was analyzed; 3 1/3 ft slope above elevation 530.5, 2 1/3 ft slope at elevation 527.0 and 3 ft slope below elevation 521.6. To the extent that failure would be limited to the embankment, the lowest factor of safety found was 1.37. This was based on the saturated shear parameters for Sample 657505 (cm) and assumed full drawdown. Study of this analysis led to the conclusion that the foundation would have to be considerably stronger than the embankment values used in order to resist failure. Therefore, additional foundation information was requested (Ref. 1). Density information obtained at the sites, along with
the evaluation of Sample 6543573, led to the assignment of shear parameters of $\phi = 25^\circ$ and $c = 100$ p.s.f. to the foundation.

The second part of the analysis was based on conditions at Station 6+57 with a 5-foot foundation having parameters of $\phi = 25^\circ$, $c = 100$ p.s.f. At Station 6+57 the dam will be 57.8 feet high. It was found that the 2 1/2:1/3:1 slope with a 12-foot berm at elevation 561.0 gave a factor of safety against embankment-foundation failure. It was found that an additional 23-foot berm at elevation 560 was required to bring the factor of safety up to 1.90.

The downstream slope of the embankment was initially assumed to be 2 1/2:1 with a drain at $c = 0.65$. Initial slope analysis for a dry slope like Sample 6543577 (non-plastic S2) gave a factor of safety of 1.65. Sliding Wedge analysis of the 2 1/2:1 slope sliding on the 25°-100 p.s.f. foundation gave a factor of safety equal to 1.97. Ordinarily, a factor greater than 2.0 is the minimum of acceptability for the Sliding Wedge analysis. The Scaled Circle Method of analysis gave a factor equal to 1.15 for the 2 1/2:1 slope with a drain at $c = 0.65$ and with a 5-foot "corrected" foundation. It was found that a 23-foot berm at elevation 560 was required to raise this factor of safety to 1.90.

**Recommendation**

- Outlet and Erosion: A positive outlet is recommended. A sluice with vertical permeation to sand berm. A wide trench bottom is recommended in the zone below the normal pool to assure good bond with the bermend. A portion of 25 feet should be adequate. During the excavation of the bermend into the sediments, the bermend should be carefully excavated. Open men and access should be provided with "dental grouting", so that the grout will not be exposed. The outlet should be connected with some of the more plastic material compacted to 95 percent of Standard density.

Foundation drainage will not be required, since positive outlet is to be provided. However, embankment drainage is required for stability and protection against piping. In the event where there are areas, it is desirable to extend the embankment drain down to pick up the flow. This can be done with blind drain, in the same manner described in A. An example: From S08 353 shows the recommended filter limits. A thickness of at least 18 inches of filter should be used. The drain should be located at $c = 0.65$ and should extend to elevation 576.

- Principal Spillway: The principal spillway location appears to be satisfactory. Total consolidation and various horizontal unit strain are expected to be quite low. Since the entire principal spillway has been trench out with pita, it is recommended that the trench be cut with a 30-foot bottom on bedrock and with 2:1, or flatter, side slopes. This trench should be backfilled with some of the materials recommended for the upstream slope. The backfill should be compacted to at least 95 percent
of Standard density with moisture contents very near optimum. It is
recommended that a protective filter entirely surround the conduit at
the drain line.

5. Embankment Design: There are three basic alternatives that are consistent
with the data available and the analysis based on these data. Briefly,
these alternatives are: (1) silted in place on the canal; (2) material.

The following recommendations are

1. Silted

   Alternative 1- (Silted In-Place)

  [equation]

   Alternative 2- (Silted In-Place)

   Alternative 3- (Silted In-Place)

2. Embankment Material: (See appendix D, 503.0) A plan of selective

   placement of material taking into account flood plains, positive

   slopes in the upriver slope and backfill area, and sediment [as per

   scour calculations, were designated to occur at the downstream area].

   It is extremely important to keep the soil with little or no cohesion

   out of the upriver slope, since flood would tend to cause serious

   failures in such materials. Filling the toe with loose material down

   stream would also help cause diversion of the plastic surface by the

   dam, thus guiding the downstream slope face against cavity seepage.

   Since the stability analysis assumed this condition, it is also rather

   important. The plan of selective placement agrees, for the majority

   of the materials, with the plan recommended by the Geologists. The

   differences are based primarily on grain size distribution and plastic-

   ity considerations.

VI-6
To be used to report to field offices data used for slope stability analyses and the results of the analyses. The right side of the form will be used for a sketch of the embankment on which the analyses have been made.

<table>
<thead>
<tr>
<th>Trial Slope</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td></td>
</tr>
<tr>
<td>C.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>Material</th>
<th>63W</th>
<th>63W</th>
<th>63W</th>
<th>63W</th>
<th>63W</th>
<th>63W</th>
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</thead>
<tbody>
<tr>
<td>S.S.</td>
<td>1150</td>
<td>1185</td>
<td>1185</td>
<td>1185</td>
<td>1185</td>
<td>1150</td>
<td>1150</td>
</tr>
<tr>
<td>C.I.</td>
<td>620</td>
<td>620</td>
<td>620</td>
<td>620</td>
<td>620</td>
<td>620</td>
<td>620</td>
</tr>
<tr>
<td>C.</td>
<td>1185</td>
<td>1185</td>
<td>1185</td>
<td>1185</td>
<td>1185</td>
<td>1150</td>
<td>1150</td>
</tr>
</tbody>
</table>

Date of Analysis: 12/24/57

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSULTING SERVICE LABORATORY

State Virginia
SUMMARY - SLOPE STABILITY ANALYSIS

Trial: What Out Run Site #1

Analysis Made By: I.T.

Checked By: G.W.
<table>
<thead>
<tr>
<th>Location of Material</th>
<th>Found</th>
<th>ML</th>
<th>Correlated</th>
<th>ML</th>
<th>Correlated</th>
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</thead>
<tbody>
<tr>
<td></td>
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</tbody>
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<table>
<thead>
<tr>
<th>Sample No.</th>
<th>T_d</th>
<th>T_n</th>
<th>T_p</th>
<th>T_b</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

### UPSTREAM SLOPE

<table>
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<th>Trial</th>
<th>Slope</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>2 1/2</td>
<td>Full drawdown, 100' berm @ elev 564.0. Art cut from opp. hill. Transfer, 55, 550' Correlated 250' - 100'. See shear values only.</td>
</tr>
<tr>
<td>6</td>
<td>2 1/2</td>
<td>Some as 5' but tangents Paint moved upstream 46.0</td>
</tr>
<tr>
<td>7</td>
<td>2 1/2</td>
<td>Some as 5' but tangents Paint moved upstream 46.0</td>
</tr>
<tr>
<td>7A</td>
<td>2 1/2</td>
<td>Some as 5' but 26.0' berm added at elev 566.0</td>
</tr>
</tbody>
</table>

### DOWNSTREAM SLOPE

<table>
<thead>
<tr>
<th>Trial</th>
<th>Slope</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>2 1/2</td>
<td>Drainage channel - No berm. Art cut from opp. hill. Transfer, 56, 550' Correlated. See shear values only.</td>
</tr>
<tr>
<td>8A</td>
<td>2 1/2</td>
<td>Some as 5' but tangents Paint moved downstream 19.0</td>
</tr>
<tr>
<td>9</td>
<td>2 1/2</td>
<td>Some as 5' but tangents Paint moved downstream 19.0</td>
</tr>
</tbody>
</table>

---

To be used to report field office data used for slope stability analyses and the results of the analysis. The right side of the form will be used for a sketch of the embankment on which the analyses have been made.
1964 STABILITY CALCULATIONS
USE OF BORROW MATERIALS

<table>
<thead>
<tr>
<th>Section</th>
<th>Quantity</th>
<th>Quantity Used</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>75,000</td>
<td>75,000</td>
<td>100%</td>
</tr>
<tr>
<td>II</td>
<td>25,000</td>
<td>25,000</td>
<td>100%</td>
</tr>
<tr>
<td>III</td>
<td>25,000</td>
<td>25,000</td>
<td>100%</td>
</tr>
<tr>
<td>Total</td>
<td>125,000</td>
<td>125,000</td>
<td>100%</td>
</tr>
</tbody>
</table>

1. Includes Foundation, E. Trench, and Trench, which may be 10' with
   excess spread 10'.

Proportions For Each Section Use Estimated Actual Unit
Section At Station 9+77.

Section I Compacted Fill Class E2
Use Silt (ML) and CL1 (CL)
Represented By The Log of Test P10
119 from 1' to 3'
121 from 1' to 4'

Section II Compacted Fill Class E2
Use Silt (ML) and CL1 (CL)
Represented By The Log of Test P10
261 from 1' to 4'
108 " 1' to 8'
113 " 1' to 8'
129 " 1' to 7'
133 " 1' to 9'
137 " 1' to 4'
140 " 1' to 11'
VI-12
Section II: Computed Fill Cross 'B' Use S.71, Solid (SM) Represented by the Log of Test Pits
209 front 1' to 2'
316, 1' to 4'
148 1' to 4'

Check Stability of Proposed Sections Using the following Values:

Section I
φ = 12°  ε = 1,000  psf  0.3% strain
γ = 92 psi  γ = 17.5°  ε = 775 psi
f = 105 psi  from Lab. Environ.
K = 120 psi

Section II
φ = 15.5°  ε = 500 psi
γ = 100 psi  γ = 31.5°  ε = 500 psi
f = 121 psi  from Lab. Environ.
K = 125 psi

Section III
φ = 24°  ε = 400 psi
γ = 102 psi  φ = 33.5°  ε = 90 psi
f = 123 psi  from Lab. Environ.
K = 127 psi

Foundation
φ = 18°  ε = 100 psi
γ = 90 psi  φ = 25°  ε = 100 psi
f = 104 psi  from Lab. Report
K = 118 psi
MISSING FROM SCS COPY
NOTE: USE LAB RECOMMENDATIONS FOR SHEAR VALUES

\[
\text{SECT II } \phi = 31.5^\circ \quad c = 300 \text{ psi}
\]

\[
\text{SECT III } \phi = 33.5^\circ \quad c = 0 \quad \text{psi}
\]

\[
\text{FOUND. } \phi = 25^\circ \quad c = 100 \quad \text{psi}
\]

\[
C_l b = 34.5 \times 300 = 10,350^2
\]

\[
4.2 \times 10 = 0
\]

\[
66.2 \times 100 = 6,620^2
\]

\[
\text{TOTAL } 18,370^2
\]

\[
\text{N TAN } \phi = 0.32 \times 2490 \times 0.615 \div 12,540^2
\]

\[
4.85 \times 2490 \times 0.662 \div 7,960^2
\]

\[
6.40 \times 2490 \times 0.187 \div 83,430^2
\]

\[
\text{TOTAL } 167,640^2
\]

\[
\text{SF } = \frac{167,640}{132.2} = \frac{126.5}{132.2}
\]

\[
\text{SF } = 1.41
\]

NOTE: DOWNSTREAM FOUNDATION MATERIAL IS ACCEPTABLE.
Flow through System

Flow Through Filler: (Conservative, Because Cut-off is deep into bedrock)
Use Darcy Eq. \( q = k \frac{h}{L} \alpha \)

\[ q = 12 \left( \frac{22}{23} \times 0.6 \right) = 17.2 \text{ ft}^3/\text{sec} \]

Flow Through Abrasion
Use Darcy Eq. \( q = K \frac{L}{h} \alpha \) Assume \( K = 0.5 \) for flow not more

\[ q = K \frac{L}{h} \alpha \] \[ h = 1.5 \text{ ft} \]

Total Drainage Flow by Bedrock Flow (Leaving 0.5 in Screen Drainage)

\[ Q = 17.2 (0.5) + 17.2 = 18.05 \text{ ft}^3/\text{sec} \]

Check Capacity 6 in. C. H. pipe for bleed down pipe

\[ A_K = \frac{4}{12} \times \frac{1}{12} = 0.0067 \times 0.167 = 0.0011 \times 0.02 \times 2 = 0.005 \]

Flow in Channel Dr. D. Equal in Width

Highly Less Than L in Hard. Flow this Knur. camper & fill the fill. Chilly Less

VE-LJ
APPENDIX VII

GEOLOGIC REPORT
DETAIL GELOGIC INVESTIGATION OF DAM SITES

GENERAL

Virginia
County
Madison

White Oak Run

State

White Oak Run, Fund #308
D-6 T. P. T. T. E. L.
L. A. Gorman & T. Marsh
John Deere tractor mounted backhoe

Investigator

Cooper & Co. Inc.

White Oak Run

Structuring class

Site

D-6 T. P. T. T. E. L.

Date

March 1963

SITE DATA

Drainage area

328 acres

Type of structure

Earthfill

Water Supply & Flood Prevention

Elevation of valley floor

32 feet

Minimum height of dam

80,000 feet

Estimated volume of completed dam

700 feet

STORAGE ALLOCATION

<table>
<thead>
<tr>
<th>Sediment</th>
<th>Surface Area (acres)</th>
<th>Depth of Dam (feet)</th>
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<tr>
<td>1.39</td>
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<td>15</td>
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<tr>
<td>0.53</td>
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<td>Water supply</td>
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SURFACE GEOLOGY AND PHYSIOGRAPHY

Piedmont province

Mountains

Physiographic description

Topography

Artificial levee: Dep Strike

% slope: 20

Average percent slope:

Kernersville granite: The dam site is in an area predominately underlain by granite. A large amphibolite (hornblende-plagioclase feldspar gneiss) dike occurs approximately 275 feet west of the centerline of the dam. The strike of this dike in this area is generally N 45° E.

Minerals occurring in the granite are orthoclase and plagioclase feldspar, biotite, quartz and pyromorphite. The granite ranges from coarse grained to porphyritic in texture.

Crystals of feldspar generally form the porphyries. It has been assigned by Nelson (1962) to the Virginia Blue Ridge complex which is of Pre-Cambrian age.

The minerals in the amphibolite dike are hornblende and plagioclase feldspar. Of these hornblendes is by far the most abundant. This gives the rock a black slightly vitreous luster. The plagioclase occurs in very gneissic bands that are generally about an inch apart and less than a tenth of an inch in thickness.


Also present is a minor amount of quaternary alluvium. This is on the banks of the larger streams which flow in a strongly entrenched dendritic drainage pattern.

VL-1
VA-480-0
DETAILED GEOLOGIC INVESTIGATION OF DAM SITES

State: Virginia  County: Madison  Watershed: White Oak Run  Subwatershed:  
Site number: 1  Site group: I  Structure class: b  Investigated by: L.A. Gorman & T. Mack  Date: March 1963

For in-service use only

INTERPRETATIONS AND CONCLUSIONS

1. Abutment foundation conditions appear adequate. Hard firm bedrock was encountered on the centerline of the dam. Very minor vertical jointing was observed. This should cause no trouble. As the rock is igneous and massive, no bedding is present.

2. The principal spillway was trenching out and a rock line established. Hard unweathered bedrock was found forming a continuous shelf generally 6 feet below ground level.

3. An impermeable core should be installed and the core trench should extend for one foot into the unweathered bedrock.

4. Foundation drains may have to be installed, although a 2 foot thick gravel layer exists below the silty sand covering the flood plain. This gravel layer might possibly be used as a natural filter. Sample 3 of 2 is a representative of this gravel.

5. The emergency spillway cut appears to be composed of shallow soil and unweathered bedrock. Bedrock excavation will be necessary. The bedrock is hard resistant granite. The site will be drilled and a supplementary report will be issued.

6. Sufficient borrow material is present in the borrow area. Enclosed is a soil correlation table.

7. This dam is to be a water supply structure, so precautions should be taken to insure the safety of the dam because of the greater depths of water. The bedrock underlying this proposed structure is quite impermeable, so the amount of water going to the local ground water will be negligible, therefore, the only consideration should be the safety of the structure. The site will be drilled and additional information regarding permeability and leakage zones will be issued in a supplementary report.

VA-480-G

VII-2
## SOILS CORRELATION Table

(To Accompany Geology Report for Site 3 in VA)

<table>
<thead>
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<th>Field No.</th>
<th>Depth from - To</th>
<th>Unit Class</th>
<th>No.</th>
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<th>Location</th>
<th>Core etc.</th>
<th>Remarks</th>
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<td>106</td>
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<td>Shallow</td>
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- **Represents Soils from:**
- **Purpose or Use:**
- **Suggested Quantity:**
- **Remarks:**

*Site No.: I, State: VA, Prepared by: Hack, T., Date: Feb. 1963*
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"9-ESR Unit
or Darby, Pa.
January 10, 1962"
### SOILS CORRELATION TABLE

*EDITED AVAILABLE* - 2 -

(To Accompany Geology Report for In-Situ Soil Study)

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### Soil Consistency Table

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<td>SM</td>
<td>213</td>
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**EDP Unit**

er Derby, Pa.

January 10, 1962

VII-6
### SOILS CORRELATION TABLE

**White Oak Run Site No. I State VA. Prepared by Mack T. Date Mch. 1963**

<table>
<thead>
<tr>
<th>Field No.</th>
<th>Depth From - To</th>
<th>Unit. &amp; Class. No.</th>
<th>Unit. &amp; Class. From - To</th>
<th>Purpose or Use</th>
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<th>Unit. &amp; Class. From - To</th>
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4-ENF Unit
per Darby, Pa.
January 10, 1962
Resume' of Pressure Testing

A total of four holes were tested. The following is a resume' of the results:

DB-1 - 14 90', Dam Elev. 581.2'

Zone 6.0 - 11.0'
11 GPM at 5 PSI
12 GPM at 10 PSI
15 GPM at 20 PSI
22 GPM at 30 PSI

Zone 11.0 - 14.0'
No leakage @ 30 PSI

DB-2 - 8 13', Dam Elev. 582.3'

Zone 5.0 - 10.0
10 GPM at 5 PSI
12 GPM at 10 PSI
13 GPM at 20 PSI
17 GPM at 30 PSI

Zone 10.0 - 15.0
1 GPM at 30 PSI

Zone 15.0 - 20.0
8 GPM at 5 PSI
13 GPM at 10 PSI
15 GPM at 30 PSI

Zone 20.0 - 22.2 (bottom of hole)
No leakage at 30 PSI

DB-3 - 6', Dam and Spillway 550.1'

Zone 11.9 - 16.9
No leakage at 5 PSI
1 GPM at 30 PSI

DB-4 - 5 30', Dam Elev. 575.7'

Zone 3.5 - 8.5
13 GPM at 10 PSI
22 GPM at 30 PSI

Zone 5.5 - 10.5
No leakage at 30 lbs. pressure
APPENDIX VIII

REFERENCES
REFERENCES


NAME OF DAM: WHITE OAK

VIII-1


NAME OF DAM: WHITE OAK

VIII-2