INSPECTION REPORT

WITCHES WOODS LAKE DAM
CT DEEP #16907

CROOKED TRAIL
BUNGGEE BROOK
WOODSTOCK, CONNECTICUT

PREPARED FOR:

WITCHES WOODS TAX DISTRICT

MARCH 2016

Prepared by:

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Connecticut Department of
Energy & Environmental Protection
Bureau of Water Protection & Land Reuse
Inland Water Resources Division

DAM SAFETY PROGRAM
DAM INSPECTION REPORT FORM – FOR REGULATORY INSPECTION

Please complete this form in accordance with the instructions (DEEP-DAM-INST-002).

Part I: Summary of Dam Inspection

Dam Name:	**Witches Woods Lake Dam**	Inspection Date(s):	**April 27, 2015 August 18, 2015 November 4, 2015**
Alternate Dam Name(s):	**Witches Woods Dam Lower Bunggee Dam**	CT Dam ID #:	**16907**
Location (Municipality):	**Woodstock**	Temperature / Weather:	**Overcast, Mid 50's (April 27, 2015) ========== Sunny, 80° F (August 18, 2015)**
Registered?: Yes or No If yes, provide the 9 digit registration number found on the notification letter.	**201402191**	Pool Level: See Instructions	**2" Above Spw. Crest. (April 27, 2015) ========== 3" Below Spw. Crest (August 18, 2015)**
Emergency Action Plan?: Yes or No If Yes, see instructions	**No (See Other Information)**	Impoundment Use: use options listed in instructions	**Recreation & Conservation**
Hydraulic and Hydrologic Analysis?: Yes or No If Yes, see instructions	**Yes (See Other Information)**	Stability Analysis?: Yes or No If Yes, see instructions	**No (See Other Information)**
Overall Condition: (refer to Appendix A located at the end of this form) **Good**			

Persons present at the inspection *(select the tab button in the last cell to the right to create another row)*		
Name	**Title/Position**	**Representing**
Karl F. Acimovic, P.E.	**Consulting Engineer**	**Inspector**
Jim Hutten	**Chairman – Lake, Dam & Beach Committee**	**Witches Woods Tax District**

Owners and Operators: If there is more than one owner or operator, copy the empty table below for each owner or operator and paste right below the previous table, then complete the information for each

*By providing this e-mail address you are agreeing to receive official correspondence from DEEP, at this electronic address, concerning the subject report. Please remember to check your security settings to be sure you can receive e-mails from "ct.gov" addresses. Also, please notify DEEP if your e-mail address changes by email via deep.damsafety@ct.gov.

Indicate if Owner or Operator: Owner & Operator

Name: **Witches Woods Tax District / Glen Humes, President / Jim Hutten, Chm. – Dam Committee**

Mailing Address: **25 Crooked Trail**

City/Town: **Woodstock** State: **CT** Zip Code: **06281**

Phone: **(860) 974-2518 / Jim Hutten, Chm. – Dam Committee** ext.:

Emergency Phone:

*E-mail: **HJHutten@charter.net**

Part II: General Dam Information

General Description: The dam consists of a spillway tucked into the right embankment of the dam, which spillway is about 64 ft. wide with two concrete piers for the support of a pedestrian bridge, followed by an earth embankment dam section approximately 950 feet in length running left of the spillway. There is an auxiliary dike section of about 200 ft. in length, separated from the main dam by approximately 250 feet of natural ground. The upstream slope of both the dam and dike is mild, whereas the downstream slope is fairly steep with gradients varying from 1H:1V to 2H:1V. Along the top of the dam, the crest is traversed by a grassed access path for maintenance between the spillway and the house off the center of the dam, followed by a gravel roadway that continues past the end of the dike section.			
Hazard Classification:	B	**Dam Height (ft):**	16 ft.
Dam Length (ft):	950 ft. (Dike – 200 ft.)	**Spillway Length (ft):**	64 ft. (Total) 57 ft. (Open – without piers)
Spillway Type:	Broad Crested Concrete Weir (32" Width)	**Normal Freeboard (ft):**	5 ft.
Drainage Area (square miles):	3.85 sq. mi.	**Impoundment Area (at principal spillway crest, in acres):**	70 Ac.
Watercourse(s):	Bunggee Brook		

OTHER INFORMATION:

History – According to district records, the dam was built in the 1960's. This was confirmed by record plans on file at the DEEP, dated October 1963. This plan showed a dam approximately 1,600 to 1,700 feet in length and included two areas of natural ground within its length. At the center of the dam was the proposed spillway. While the dam was built in the area shown, the spillway was actually constructed directly at the right abutment of the dam, rather than at its center. The proposed location of the spillway instead became the location of a low level outlet. The current pedestrian bridge, replacing a former wooden structure, was not installed until the mid-1980's period.

Although no as-built record was found from the initial construction, a later plan was prepared by Heynen Engineers in September of 1991 and approved for construction by the DEP in November of 1992 for repairs and modifications. This then showed the current site configuration, with the spillway at the right abutment. An as-built plan was prepared in 1993 and found to be on record at DEEP Dam Safety. The work appeared to have included raising of the embankment to an even elevation across the length of the dam (for additional freeboard) and provided for installation of toe drains in two locations near the middle and left side of the dam. Later commentary from another report indicated that the raising of the embankment had not been included in the work.

Additional plans were prepared in 2007 by J & D Civil Engineers for repairs to the underdrain or toe drain system and the replacement of the low level outlet (consisting of a 21" corrugated metal pipe and gate valve) with a new 42" Class V reinforced concrete pipe and Rodney Hunt sluice gate on the upstream side. This work was reviewed and accepted by the DEP in July of 2010. Subsequently, minor repair work on the concrete spillway (crack and spall repairs) was completed in 2012.

Phase I Report - No documentation of a Phase I report was found in the records of the Connecticut DEEP Dam Safety Section. A request was made to the Corps of Engineers for a copy, but no response was received at the time of the preparation of this report. Because of the existence of a Phase II Report, it is assumed that a Phase I was completed, although no records of such were available for review during for this inspection.

Other Reports – Reports on record include a Phase II Report prepared by Heynen Engineers in 1984 and a Hydrologic / Hydraulic Analysis prepared by J & D Civil Engineers in 1994. The Phase II Report preceded work done in 1993, while the J & D Report was completed while later repairs were ongoing in 1994.

Hydrologic and Hydraulic Analysis – The Hydrologic / Hydraulic Analysis prepared by J & D Civil Engineers in

1994 was initiated to check on the necessity of raising the embankment. The conclusions of the report indicated that the then current height of the dam was sufficient and did not need to be raised. The 100-year storm was found to have a freeboard of 1.9 ft., while the 500-year event had a freeboard of 1.4 ft.

Stability Analysis – No formal stability analysis was on record. It is assumed that the issue was addressed in a Phase I Report, but no record of such was available. One comment in the Phase II Report did indicate that "*The Miscellaneous Fill does not create a stability problem.*" The current inspection noted that there were no direct signs of instability, but that mower / maintenance damage in two locations could lead to sloughing along steep portions of the embankment.

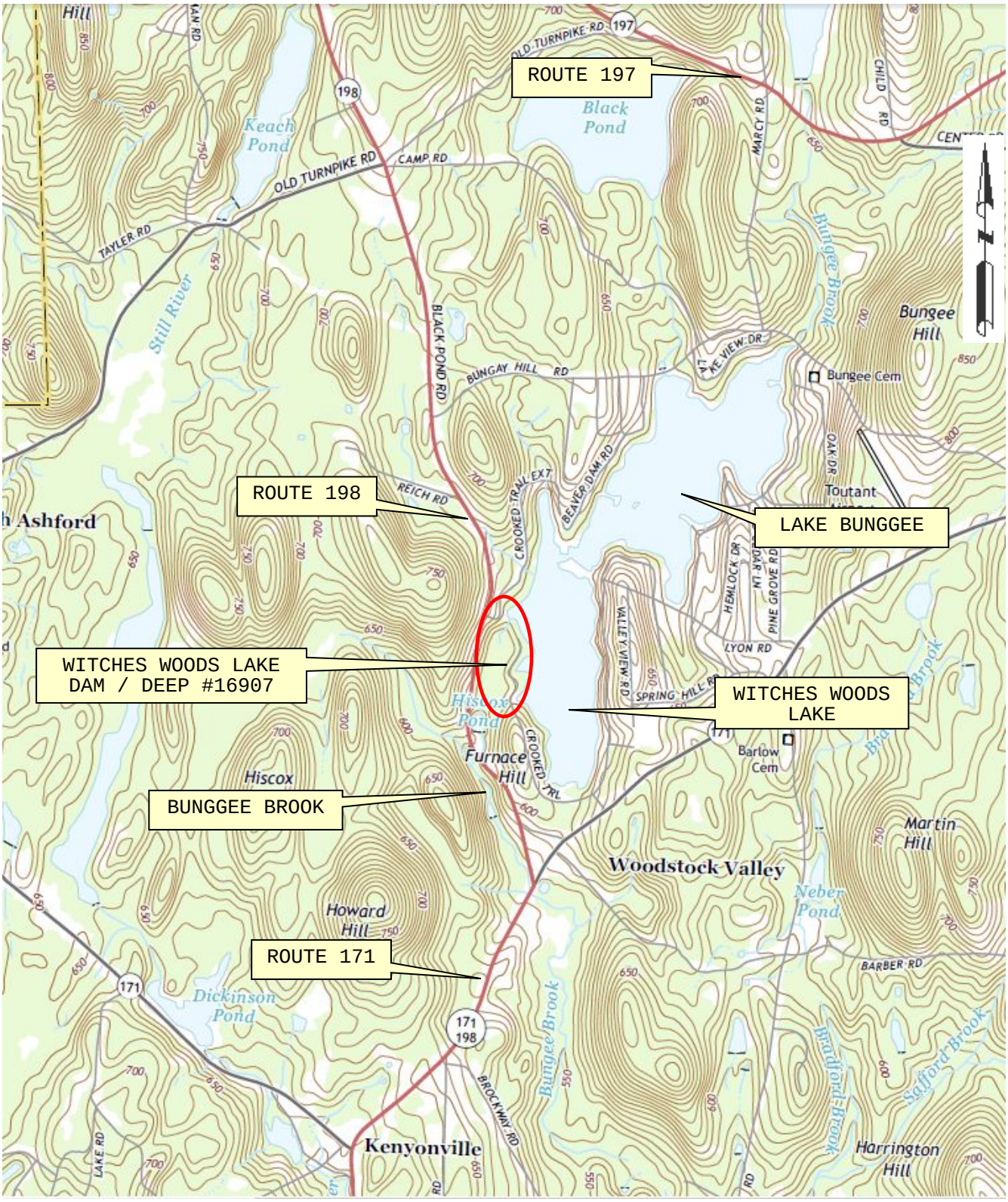
Emergency Plan – No emergency plan was found to be in place for this site. Based on the current hazard rating, such will be required for the event of an emergency situation. An EAP is currently under preparation by the undersigned engineer and will include both inundation mapping and updated DEEP Dam Safety guidelines.

Diving Inspection – There was no indication that any recent diving inspection had been carried out for this dam.

Part III: Aerial Photo/Location Map

Witches Woods Lake and Vicinity
(*Source: Bing Maps*)

(*Source: Bing Maps*)



(*Source: USGS 2015*)

Part IV: Dam/Embankment/Dike Information

Number of Dam Embankments / Dikes: 2

Dam Embankment Name: Witches Woods Lake Dam

General Description: The dam consists of a spillway tucked into the right embankment of the dam, which spillway is about 64 ft. wide with two concrete piers for the support of a pedestrian bridge, followed by an earth embankment dam section approximately 950 feet in length running left of the spillway. There is an auxiliary dike section of about 200 ft. in length, separated from the main dam by approximately 250 feet of natural ground. The upstream slope of both the dam and dike is mild, whereas the downstream slope is fairly steep with gradients varying from 1H:1V to 2H:1V. Along the top of the dam, the crest is traversed by a grassed access path for maintenance between the spillway and the house off the center of the dam, followed by a gravel roadway that continues past the end of the dike section.

General Condition: Good to Fair. Good based on the maintenance of a well-kept grass cover; fair, based on the saturated toe conditions in the areas noted below.

Concrete Condition: Not applicable.

Stone Masonry: Not applicable.

Settlement / Alignment / Movement: Two small areas of minor mower damage and potential sloughing were noted approximately 200 feet and 800 feet left of the spillway on the downstream side of the earth embankment. These areas are not a safety issue at this time, but recommendations with respect to maintenance have been included in this report.

Seepage / Foundation Drainage: Foundation or toe drains, while not included in the original layout of this dam, were later designed and installed along two wet and susceptible areas of the downstream embankment in the vicinity of the sharp bend approximately 400 to 600 feet left of the spillway. Past records indicated that they were functioning as designed, but have since deteriorated or been damaged by maintenance equipment to the point where there are wet spots and ruts with standing water in the locations noted. Recommendations for action have been included in this report.

Riprap: Not applicable.

Erosion / Burrows: No burrows were noted, but sloughing was addressed above. While there was no erosion noted at the time of inspection, such areas may become susceptible to erosion in the event of a severe storm situation.

Vegetative Cover: Grass for the most part, interspersed with some weeds and other native plants.

Other: There is a gravel access road on the left end of this embankment to serve both for maintenance and for access to a house situated on a small patch of original ground on the upstream side opposite the sharp turn in the embankment.

Photos/Graphics/Sketches: See Photo Report in Section XIII.

Dike Name: Witches Woods Lake Dike

General Description: An earth embankment dike with a sandy beach on the upstream side and a vegetated grass cover on the downstream side. A gravel road runs along the crest connecting the left abutment with a patch

of natural ground situated between the right abutment and main portion of the dam.

General Condition: Good, based on a well maintained grass cover on the downstream embankment and a well-kept gravel road and beach area on the crest and upstream side, respectively.

Concrete Condition: Not applicable.

Stone Masonry: Not applicable.

Settlement / Alignment / Movement: None observed.

Seepage / Foundation Drainage: Although there is a wetland directly adjacent to the base shelf on the downstream toe, there were no saturated areas or specific signs of seeps along the base perimeter.

Riprap: Not applicable.

Erosion / Burrows: None observed.

Vegetative Cover: Grass on the downstream side; well maintained.

Other:

Photos/Graphics/Sketches: See Photo Report in Section XIII.

Part V: Principal Spillway, Training Walls, Apron

Number of Principal Spillways: 1

Spillway Type: Principal Spillway

General Description: A 32” wide broad crested weir, with a downstream sloped concrete apron that also supports two concrete piers supporting a pedestrian bridge crossing over the top of the spillway.

General Condition: Good.

Concrete Condition: Good. Minor cracks and spalls were repaired in 2012, and patches and sealant were still in good condition and holding well.

Stone Masonry: None within the spillway. A minor section was noted at the downstream end of the right side training wall, but was not considered an integral part of the main spillway.

Settlement/Alignment/Movement: None observed.

Cracks: Past cracks had been patched and sealed and, as noted above under concrete condition, were still holding well.

Scouring / Undermining: None observed.

Seepage/Foundation Drainage: None observed.

Other: The pedestrian bridge crossing the spillway was in good condition, but mild corrosion was noted on some of its steel parts.

Photos/Graphics/Sketches: See Photo Report in Section XIII.

Part VI: Auxiliary Spillway, Training Walls, Apron

Number of Auxiliary Spillways: 0

Auxiliary Spillway Type: This site has no auxiliary spillway.

General Description:
General Condition:
Concrete Condition:
Stone Masonry:
Settlement/Alignment/Movement:
Cracks:
Scouring/Undermining:
Vegetative Cover:
Riprap:
Seepage/Foundation Drainage:
Other:
Photos/Graphics/Sketches (insert either below this Part or in Parts XIII and XIV, refer to the instructions under Parts XIII and XIV for additional details)

Part VII: Downstream Channel

Number of Downstream Channels: 1

Channel Name / Watercourse Name: Bunggee Brook

General Description: A stony, gravelly channel bottom with mild wooded side slopes and a relatively steep grade for about 200 feet past the base of the spillway, and then passing into a mildly sloped channel through an extensive wetland area paralleling the road before crossing about 1,500 feet downstream.

General Condition: Good, firm channel base with no signs of scour or erosion near the dam area.

Scouring: None observed.

Debris: Minor

Riprap: Riprap ranging from modified to standard in size, randomly placed, is present for about 30 feet past the spillway apron and is in good condition.

Other: Vegetation, including brush and trees, had recently been cleared from within the riprap channel downstream of the spillway apron.

Photos/Graphics/Sketches: See Photo Report in Section XIII.

Part VIII: Intake Structure(s)

Number of Intake Structures: 1

Intake Structure Type: Primary Low Level Intake Structure

General Description: On the upstream shoreline approximately 850 ft. left of the spillway, consisting of a three-sided concrete box open to the upstream and open at the top, with a 42" x 42" Rodney Hunt cast iron sluice gate along a vertical concrete wall, leading into a reinforced concrete pipe low level outlet.

General Condition: Good, based on observations above water level and the gate's operability based on discussions with WWTD members.

Concrete Condition: Good, again based on the visible concrete above water level.

Stone Masonry: Not applicable.

Settlement / Alignment / Movement: None observed.

Cracks: None observed.

Other: The gate operating / hoisting mechanism appeared in good condition and reportedly was in good working order. The manufacturer's information is attached to the base of the hoist and can be used in the event maintenance becomes necessary.

Photos/Graphics/Sketches: See Photo Report in Section XIII.

Part IX: Outlet Structure(s)

Number of Outlet Structures: 1

Outlet Structure Type: Primary Low Level Outlet Structure

General Description: The low level outlet consists of a Class V reinforced concrete pipe passing through the base of the dam with a concrete cradle, ending in a flared end concrete section at the downstream discharge. From the area of the downstream crest, record drawings indicate the installation of a vertical sand filter which extends vertically to the base of the pipe and cradle and then continues to the discharge point.

General Condition: All visible portions of the pipe and downstream structure appeared in good condition.

Concrete Condition: The interior of the concrete pipe and the exposed portions of the concrete flared end were in good condition.

Stone Masonry: Not applicable.

Settlement / Alignment / Movement: None observed.

Scouring / Undermining: Minor scour observed within the downstream plunge pool, most likely from high flow discharges. No action recommended at this time.

Other:

Photos/Graphics/Sketches: See Photo Report in Section XIII.

Part X: Miscellaneous Features

List miscellaneous features: (e.g., access roads, bridges, etc.):

Access – Site access is available on and from both sides of the spillway, by pedestrians or construction equipment. There is an access road running along the crest of the main embankment and a ramp to the downstream base shelf both for maintenance and any potential remedial work.

Bridges – There is a pedestrian bridge across the spillway – in good condition. A vehicular bridge is not necessary at this location since there is clear access from both sides.

Safety / Security – There is fencing along the training walls of the spillway and there are no other hazardous areas requiring specific safety features.

Photos/Graphics/Sketches: See Photo Report in Section XIII.

Part XI: Downstream Hazard Classification Reassessment

Downstream Hazard Classification:

The dam is currently rated as a “B” hazard dam and, based on a visual inspection of available information with respect to downstream roads and structures, it is recommended that the rating remain as is, pending any newly available data (particularly topographic) since the original assessment was completed.

Part XII: Recommendations

1. **Vegetation** – The site is overall very well maintained. There are, however, several areas which are susceptible to encroachment by vegetation that are and should continue to be monitored and maintained. These will typically include all areas within 25 feet of the dam and its base and side perimeters and, in this case, specifically the stilling basin area with open riprap joints and the downstream shelf area directly adjacent to a widespread wetland.

2. **Seepage / Leakage** – There are several areas of seepage outbreaks along the downstream base area of the main dam embankment. It appears from past records that all the areas identified were locations at which underdrains had been installed both along the base of the embankment as well as beneath the base shelf area between the toe and the adjacent wetlands. Original plans from 1963 (on file at the DEEP) showed no provisions for underdrains. Subsequent repair plans approved by the DEP in 1992 showed a proposed toe drain in the vicinity of the dike and areas left of the end of the main embankment. As-built plans prepared in 1993 showed more extensive toe drains installed during the actual construction.

   Plans prepared in 1996 showed proposed repairs, modifications and a possible expansion of the area in the vicinity of the sharp turn near the midpoint of the main embankment. Correspondence in 1996 and a later inspection memorandum by the DEP in October of 1996 indicated that "*The modified toe drains are all functioning well ……*". Plans prepared in 2007 for the replacement of the low level outlet showed the location of the underdrains along with their discharge points, but did not indicate any issues with their functional capacity.

   Current conditions are such that something has transpired over the past several years since the installation of the drains to render them non-functional as evidenced by the wet and rutted areas noted within this report. A physical analysis appears to indicate that at least some of the issues are related to potential damage of the underdrain system by maintenance equipment over both shallow fill materials and shallow piping not designed to carry their loads. (See Photos 21j through 21l for shallow outflow areas.)

   As such, a recommendation is made to survey the area for current elevations and, to the extent possible, locate and delineate the prior underdrain field areas. The most likely method of resolving this situation may be to remove existing materials, reinstall a new underdrain system and then prepare maintenance guidelines to avoid the use of heavy equipment over the new installation.

3. **Damaged Slope Areas** – As noted in the report and pointed out in some of the photos, a small number of areas of the dam show signs of damage from maintenance equipment and minor sloughing. These areas should be repaired by placement of small amounts of fill and regrading where necessary to reestablish firm slope conditions. Where appropriate and as necessary, these areas may require the placement of slope stabilization matting. For future maintenance, instructions should be given to maintenance personnel to avoid traversing the slope with large or heavy equipment that could tear the embankment and lead to potential sloughing or slope stability issues.

Part XIII: Photographs/Graphics

Note: Some photos within this report may be duplicates. This is made necessary by the general requirement of the new DEEP / Dam Safety inspection format which requires specific numbered views for certain portions of the dam. Hence, photos which depict more than one required feature will sometimes be shown more than once to satisfy these requirements. The numbering sequence of the photos follows that of the DEEP form.

Photo 1 – The dam at Witches Woods Lake as seen from the upstream, looking south. The spillway, with extents shown by the yellow arrows, is situated directly adjacent to the right abutment of the dam. The dam itself, an earth embankment dam, extends out beyond the left side of the photo.

Photo 2 – The dam as seen from the downstream side and from the left side of the spillway. Because of the length of the dam and the various angles within the embankment, a full downstream view was not achievable for this site.

Photo 3a – The upstream face of the dam as seen from the right side of the dam, not including the spillway which is out of view just to the right of the photo. Because of the angularity of the dam's layout, some of the views may not be completely in line with the form requirements.

Photo 3b – Looking toward the left upstream and crest of the dike section from the right side, a short section of natural ground area. The lake and a small section of sandy beach area are visible at the center of the photo.

Photo 4a – A portion of the upstream face of the dam looking northerly from the left side of the embankment.

Photo 4b – The upstream side of the dam leading in to the right abutment and spillway area. The viewpoint of this photo was from just beyond the red garage seen in the previous photo.

Photo 4c – Looking at the right abutment of the dam from the left side of the spillway. The dam ends directly after the spillway as the ground level rises sharply towards the west.

Photo 5a – Looking easterly from the right abutment toward the spillway and the beginning of a long earth embankment section that turns abruptly toward the right after the spillway.

Photo 5b – The crest of the dam looking southeasterly towards a sharp bend (to the right) in the embankment at the house location. The spillway is just behind and outside the viewpoint of the photo (see prior photo). The next photo shows the crest area just beyond the house in the distance, at which point the dam embankment takes a sharp turn to the right.

Photo 5c – The crest of the embankment beyond the point noted in the previous photo. The red circle at the mailbox denotes the same point circled in the previous photo. The embankment for this section ends just beyond the viewpoint at the center, after which there is a short section of original ground (see Photo 3b) before the remaining dike section (see following photo).

Photo 5d – The crest of the dike (and upstream slope) of the dike section looking toward the left abutment area from the right abutment of the dike.

Photo 6a – The crest of the dike as seen from its left abutment area, looking in a northeasterly direction.

Photo 6b – The main dam embankment, looking northeasterly towards a sharp bend to the left. The vantage point of the photo is from the left abutment, an area of original ground between the dam and dike.

Photo 6c – The crest of the dam looking in a northwesterly direction from the sharp bend in the embankment indicated in the previous photo. The arrow in the previous photo indicates the vantage point for this photo.

Photo 7a – The downstream face of the main embankment as viewed from the left side of the spillway. Note that there is a shelf along the downstream base of the dam, the height of which varies but has an average drop of about 2 feet across the length of the dam.

Photo 7b – Another view of the downstream embankment slope as seen from the base shelf along its right side, looking toward the sharp bend toward the right at the house in the distance.

Photo 7c – A continuation of the downstream embankment slope and shelf taken from the sharp corner pointed out in the previous photo. The arrow points to riprap marking the discharge of the low level outlet passing through the dam.

Photo 7d – The downstream area continuing along the embankment from just beyond the low level outlet pointed out in the previous photo. The distant end point in this photo marks the left abutment end of the main dam embankment.

Photo 7e – The downstream embankment of the dike section, again with a base shelf between the toe of the dam and adjacent wetlands.

Photo 8a – The downstream face of the embankment as seen from the left abutment area of the dam. The riprap at the left center of the photo represents the discharge point of the low level outlet of the dam. The following photo will show the continuation beyond the sharp curve to the left beyond the red garage.

Photo 8b – A view along the downstream side of the main dam embankment, looking northwesterly toward the spillway in the distance, as seen from the sharp turn in the embankment noted in the prior photo.

Photo 9a – An upstream view of the spillway from the left side of the lake, during a high water period.

Photo 9b – Another view of the spillway from the upstream left side of the lake, but during a low water level period.

Photo 9c – The spillway as seen from the right upstream side of the lake, looking in a southeasterly direction toward the dam embankment on the far side.

Photo 10a – The spillway as seen from the downstream during an overflow period.

Photo 10b – Another view from the downstream during a low water level period.

Photo 11a – The right training wall of the spillway as seen from the left upstream side. Note that crack lines along the faces of the walls and the bridge support piers, as seen in this and other photos of the spillway concrete surfaces, are actually filled with sealant. Cleaning and sealing of cracks along these surfaces was accomplished in 2012.

Photo 11b – The lower portion of the right side spillway training wall as seen from the left side of the downstream stilling basin area.

Photo 12a – An overview of the upstream portion of the left training wall

Photo 12b – The lower section of the left spillway training wall.

Photo 13a – The weir as seen from the right training wall area during an overflow period.

Photo 13b – The weir as seen from its left side during a low water level period. There are two control joints along its length.

Photos 14 & 15 – An overview of the stilling basin area, as well as a view of the channel downstream of the spillway apron at the bottom right.

Photo 16 – An overview of the sluice gate structure on the upstream side of the main dam embankment. It consists of a sluice gate set along the vertical upstream side of a concrete wall.

Photo 17 – Since there is no gatehouse interior, we have chosen to show the interior of the low level outlet pipe, which is in good condition with no structural issues and no apparent open joints.

Photo 18 – The gate hoisting mechanism, a stem with operator attachment.

Photo 19a – The discharge area of the low level outlet pipe on the downstream side of the embankment. Note riprap protection to avoid scour.

Photo 19b – A view looking upstream at the flared end pipe discharge point for the low level outlet pipe. There is no formal inlet point other than the structure previously shown at the water's edge in Photo 16.

Photo 20 – A view of the lake looking northeasterly from the upstream side of the embankment just left of the spillway. The arrow denotes the location of the spillway for Lake Bunggee, the base of which is submerged beneath the level of Witches Woods Lake.

Photo 21a – The open riprap along the stilling basin area of the spillway creates an environment predisposed to the growth of dense brush and small tree growth within its open joints. Although tedious, these areas should be monitored and kept clear of such growth. This view looks toward the end of the left downstream spillway training wall.

Photo 21b – The same situation with respect to susceptibility for dense growth along open riprap and side slope areas.

Photo 21c - Several large trees had been removed from the stilling basin area prior to a full inspection of the site, as evidenced by the stumps noted in this photo. Again, this area should continue to be monitored and brush removed on a regular basis.

Photo 21d – A wet and rutted area near the right side of the sharp bend in the main embankment.

Photo 21e - Another wet and rutted area just beyond the one shown in the previous photo.

Photo 21f - A wet and rutted area near the left downstream end of the main embankment and just beyond the discharge point of the low level outlet.

Photo 21g – This wet and rutted area is just beyond that shown in the previous photo, close to the left end of the main embankment.

Photo 21h – The same wet and rutted area as shown in Photo 21e, but at a later date and a lower water level. Note that these wet areas persisted even with changes in water levels within the lake.

Photo 21i – The same wet and rutted areas noted in Photos 21f and 21g, this time tied together in a continuous stretch toward the left end of the main embankment. Note again the difference in saturation even with a lowered water level in the impoundment.

Photo 21j – An outlet from toe drains presumably installed or repaired in 1996, situated in the vicinity of the sharp downstream turn in the main embankment of the dam. Note the reddish stain indicative of a discharge characteristic of iron bacteria emerging from an anaerobic environment (e.g. within or below the embankment) to aerobic conditions, i.e., exposed surface water areas. Note also that in this area there is very little elevation difference between the downstream grass shelf and the adjacent wetlands.

Photo 21k – One of the old toe drain discharge points at the edge of the shelf and wetland area in the vicinity of the sharp curve on the downstream side of the main embankment.

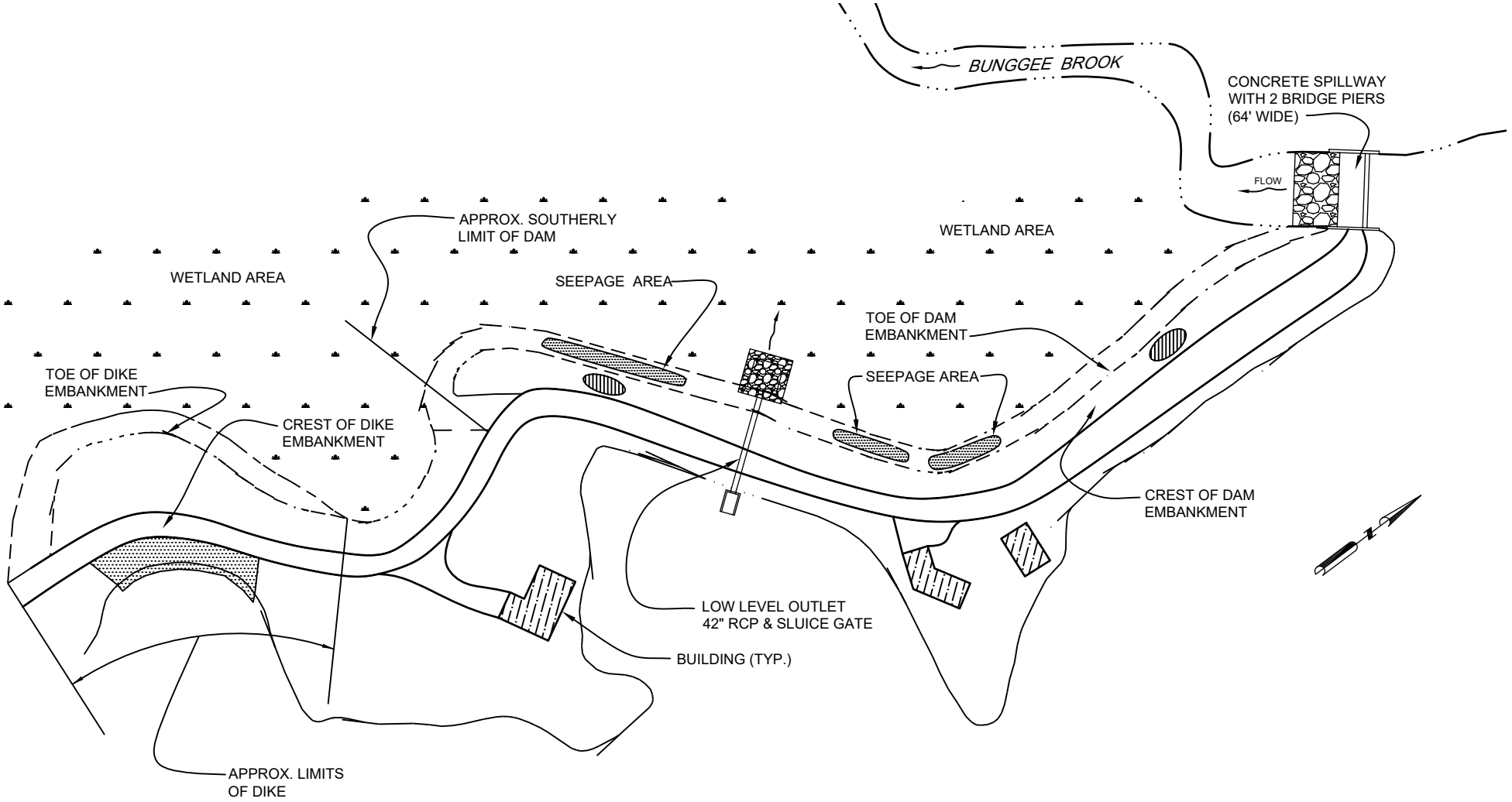
Photo 21l – Another toe drain discharge just north of the one shown in the previous photo, but without a visible pipe outlet.

Photo 21m – A small area along the left section of the main embankment in the vicinity of the low level outlet area showing signs of what appears to be minor sloughing.

Photo 21n – An area showing what appears to be damage from mowing, as shown by the wheel ruts along the base of a steep slope section. Such areas could become susceptible to sloughing if not properly maintained.

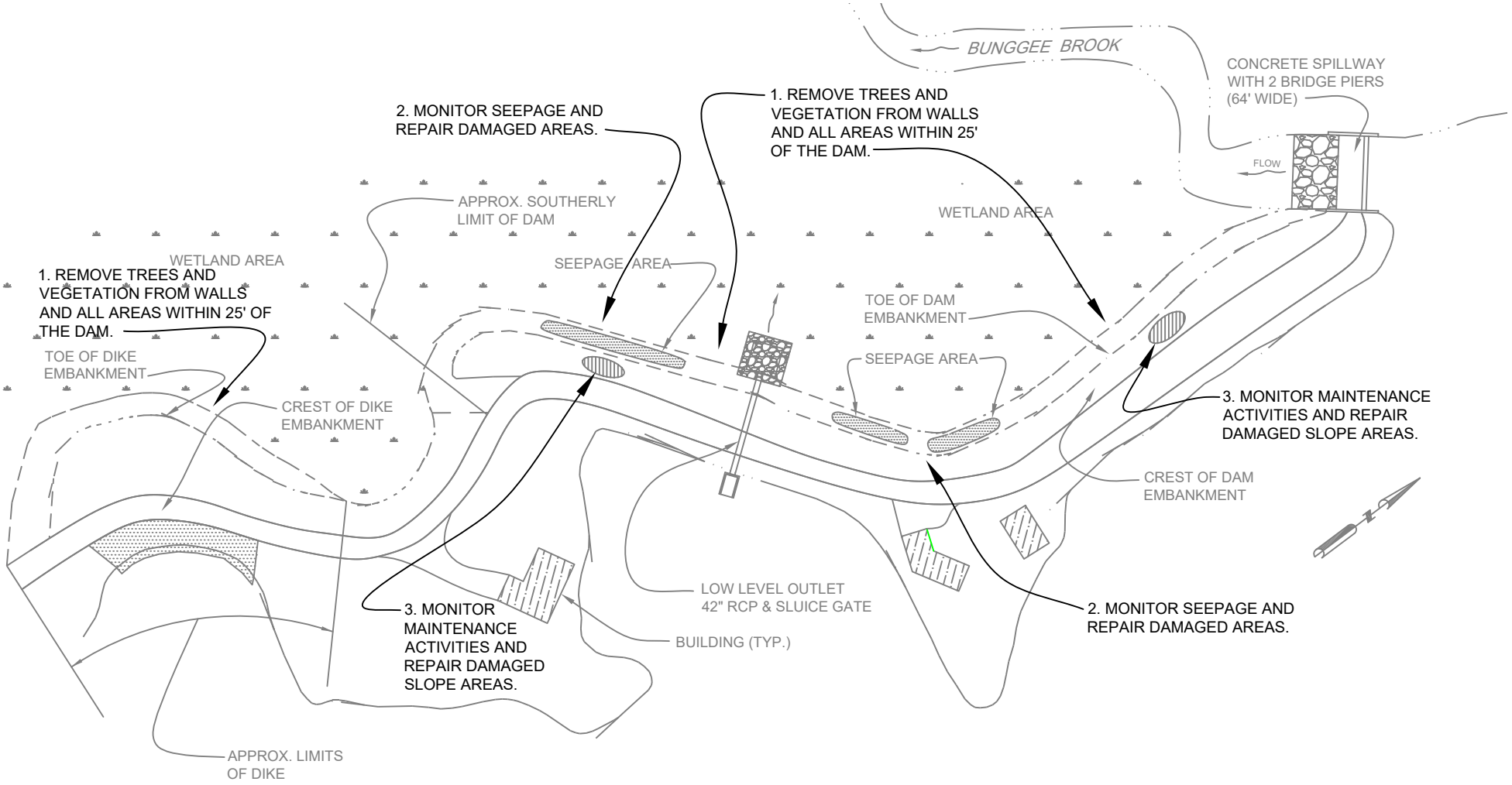
Part XIV: Sketches

See attached site plans / sketches.



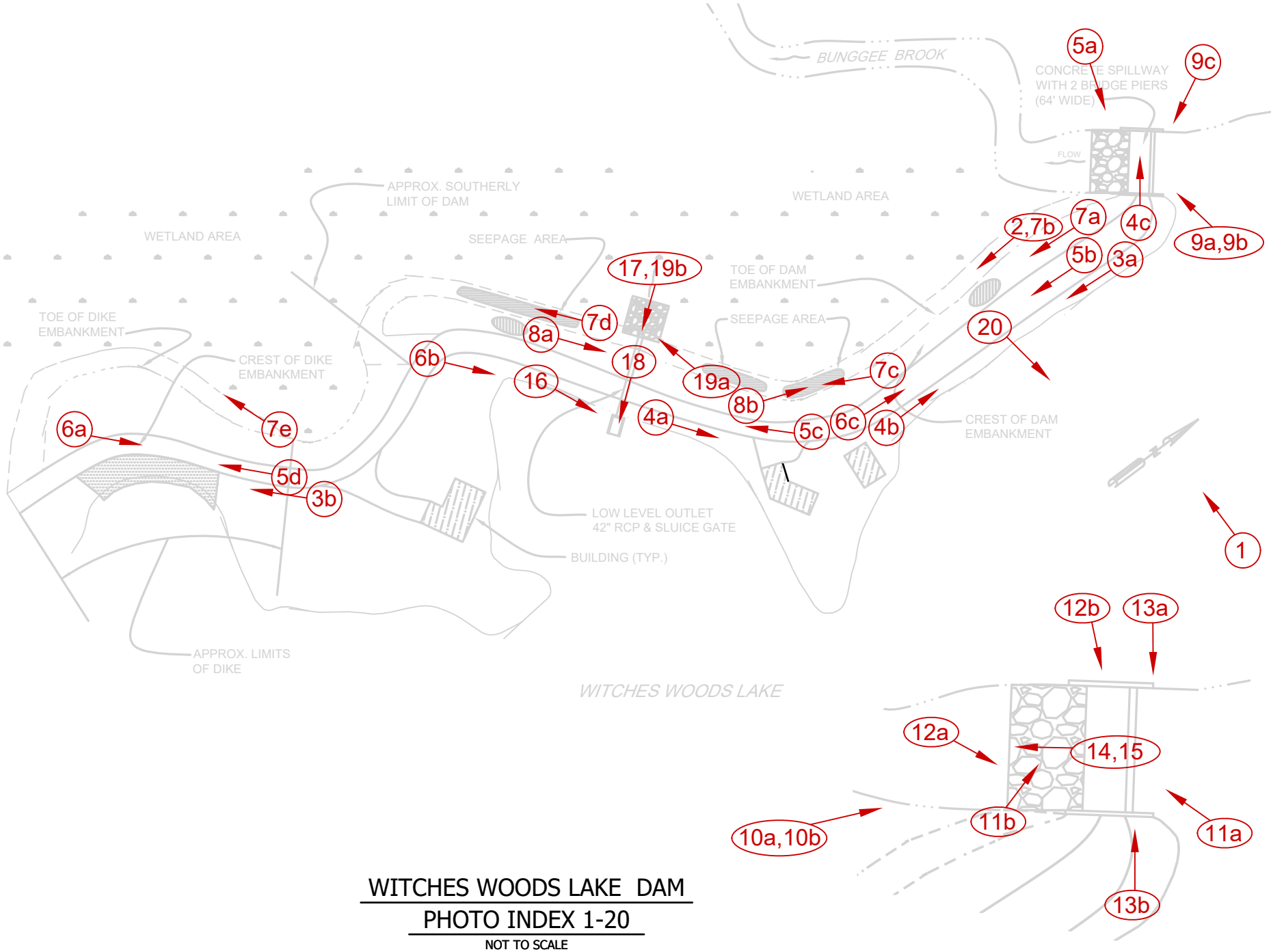
WITCHES WOODS LAKE DAM
EXISTING CONDITIONS

NOT TO SCALE



WITCHES WOODS LAKE DAM
RECOMMENDATIONS

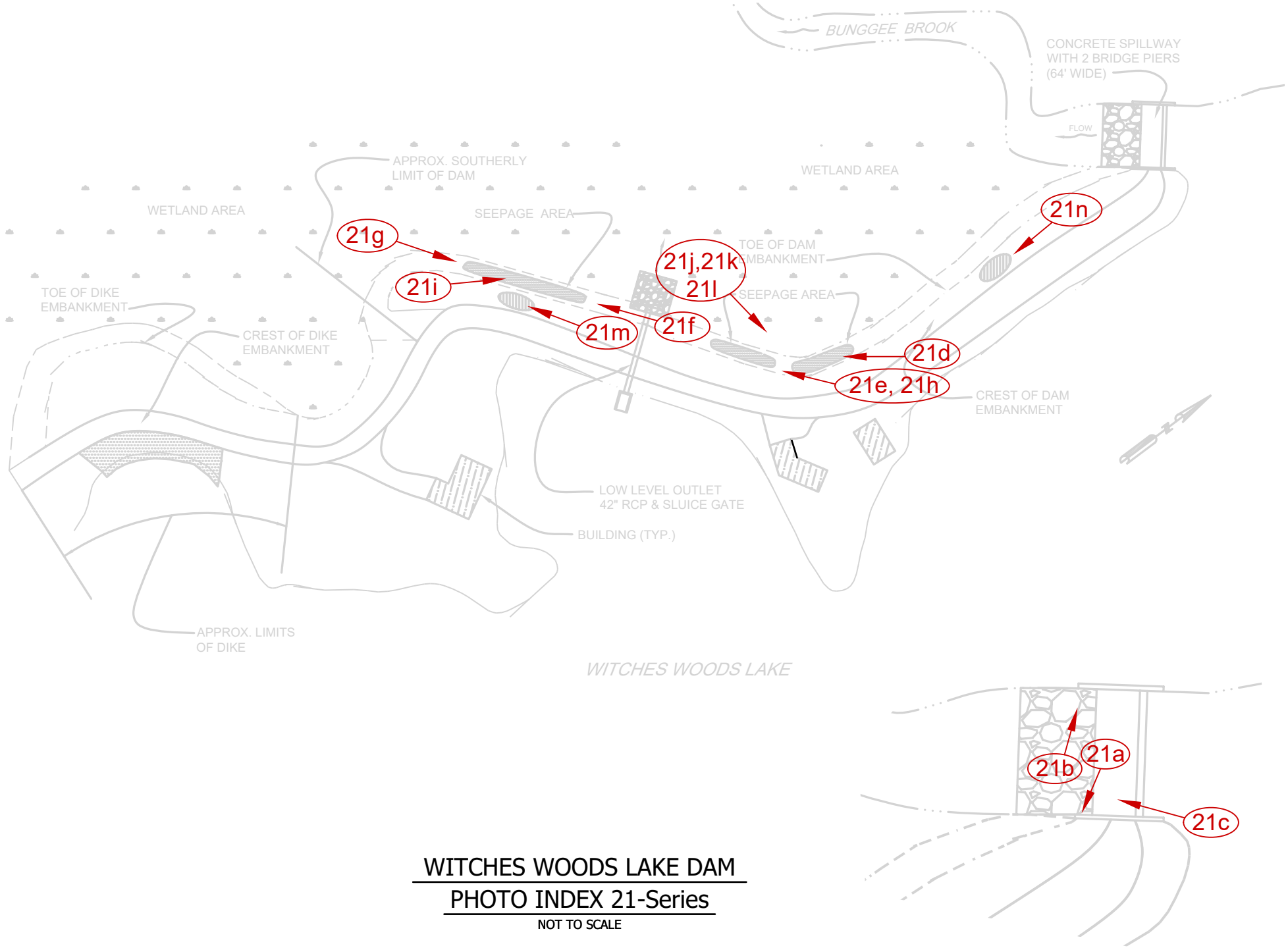
NOT TO SCALE



WITCHES WOODS LAKE DAM

PHOTO INDEX 1-20

NOT TO SCALE



WITCHES WOODS LAKE DAM

PHOTO INDEX 21-Series

NOT TO SCALE

Part XV: Professional Engineer Certification

The following certification must be signed by a Professional Engineer

"I hereby certify that the information provided in this report has been examined by me and found to be true and correct in my professional judgment."

Karl F. Acimovic 03/29/2016

Signature of Professional Engineer Date

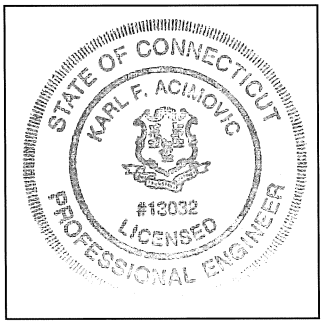
Karl F. Acimovic, P.E. **13032**

Printed Name of Professional Engineer Title CT P.E. Number

Karl F. Acimovic, P.E. & L.S., Consulting Engineer

Name of Firm

Affix P.E. Stamp Here



Part XVI: Owner Signature

The following statement must be signed by the Owner(s) of the subject Dam.

"The information provided in this report has been examined by me."

Henry J. Hutton	05-29-16
Signature of Owner	Date
Henry J. Hutton	Board Member
Name of Owner (print or type)	Title (if applicable)
Signature of Owner	Date
Name of Owner (print or type)	Title (if applicable)
Signature of Owner	Date
Name of Owner (print or type)	Title (if applicable)
Signature of Owner	Date
Name of Owner (print or type)	Title (if applicable)

Note: Mail the completed inspection report to:

DAM SAFETY PROGRAM
INLAND WATER RESOURCES DIVISION
CONNECTICUT DEPARTMENT OF ENERGY AND ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106

In addition, please send this completed report converted to Adobe portable document format (pdf) including a scan of the signature page via email to: DEEP.DamSafety@ct.gov

Appendix A: Overall Dam Condition Selection Standards

Condition	Definition
Good	Through file research and after a thorough visual inspection it has been determined that the dam is well maintained and no existing dam safety deficiencies are recognized. Only continued routine maintenance is required.
Satisfactory	Through file research and after a thorough visual inspection it has been determined that no significant deficiencies are recognized. Only minor maintenance is required and only minor flaws are noted.
Fair	Through file research and after a thorough visual inspection it has been determined that there are no critical deficiencies with the dam that would require engineering analysis with the following exception: the engineer may recommend that a hydrologic and hydraulic analysis be conducted due to the lack of adequate freeboard and/or the lack of spillway capacity documentation. A condition exists at the dam that may require some sort of additional monitoring.
Poor	Through file research and after a thorough visual inspection it has been determined that deficiencies are recognized that require engineering analysis and/or remedial action.
Unsatisfactory	Through file research and after a thorough visual inspection it has been determined that a deficiency is recognized that requires immediate or emergency action. Administrative/Enforcement action may be required as determined by the Dam Safety Program. Reservoir level restrictions may be necessary until the problem is resolved.

Appendix B - Hazard Classification of Dams

I. A Class AA dam is a negligible hazard potential dam which, if it were to fail, would result in the following:

(i) no measurable damage to roadways;
(ii) no measurable damage to land and structures;
(iii) negligible economic loss.

II. A Class A dam is a low hazard potential dam which, if it were to fail, would result in any of the following:

(i) damage to agricultural land;
(ii) damage to unimproved roadways (less than 100 ADT);
(iii) minimal economic loss.

III. A Class BB dam is a moderate hazard potential dam which, if it were to fail, would result in any of the following:

(i) damage to normally unoccupied storage structures;
(ii) damage to low volume roadways (less than 500 ADT);
(iii) moderate economic loss.

IV. A Class B dam is a significant hazard potential dam which, if it were to fail, would result in any of the following:

(i) possible loss of life;
(ii) minor damage to habitable structures, residences, hospitals, convalescent homes, schools, etc;
(iii) damage to or interruption of the use of service of utilities;
(iv) damage to primary roadways (less than 1500 ADT) and railroads;
(v) significant economic loss.

V. A Class C dam is a high hazard potential dam which, if it were to fail, would result in any of the following:

(i) probable loss of life;
(ii) major damage to habitable structures, residences, hospitals, convalescent homes, schools, etc;
(iii) damage to main highways (greater than 1500 ADT);
(iv) great economic loss.

Appendix C - PHOTOGRAPH INSTRUCTIONS

All photographs shall be color photographs. Photographs shall be clear and include scale references where applicable. Photographs shall include, but not be limited to the following:

1. Overview of dam(s)/dike(s) from upstream

2. Overview of dam(s)/dike(s) from downstream

3. Overview of upstream face from right abutment

4. Overview of upstream face from left abutment

5. Overview of dam crest from right abutment

6. Overview of dam crest from left abutment

7. Overview of downstream face from right abutment

8. Overview of downstream face from left abutment

9. Overview of spillway(s) from upstream

10. Overview of spillway(s) from downstream (tailrace or channel area)

11. Overview of right training wall(s)

12. Overview of left training wall(s)

13. Overview of weir

14. Overview of stilling basin

15. Overview of downstream channel

16. Overview of gatehouse exterior

17. Overview of gatehouse interior

18. Overview of operators

19. Outlet inlets and discharge points

20. Overview of reservoir area

21. Areas of specific deficiencies (e.g., cracks, erosion, displacement, seeps, deterioration, etc.)