



September 16, 2014  
URS Project Number 15303807

Department of Public Works  
City of Reading  
Reading, PA 19601

Attn: Ms. Deborah Hoag, P.E.

Subject: **Final Dam Portfolio Management Report  
Reading, Pennsylvania**

Dear Ms. Hoag,

URS Corporation (URS) is pleased to submit this final dam portfolio management report for Bernhart's Dam (D06-001), Bushong (Tulpehocken) Dam (D06-009), Egelman Lower (D06-003) & Upper (D06-004) Dams and Ontelaunee Dam (D06-350). This report was prepared following our review of the Pennsylvania Department of Environmental Protection (PADEP) files on February 10, 2014, evaluation of the site hydrology, and an on-site visual assessment of the dams between March 31 and April 2, 2014. This plan incorporates the observations and recommendations presented in the individual dam assessment reports provided under separate cover.

The purpose of this dam portfolio management report is to establish a prioritization of action items to address the deficiencies identified in the dam assessment reports and to provide order of magnitude rehabilitation cost estimates considering all five (5) dams. This document is intended to be used in conjunction with the individual dam assessment reports, which provide detailed descriptions and photographs of the identified deficiencies and necessary studies and/or construction to remedy the deficiencies.

This report uses the following categorizations of priority to address the deficiencies:

***High*** – The ***High*** priority designation indicates an issue that is a significant dam safety concern, for which we suggest action be taken by the City of Reading within the next year.

***Medium*** – The ***Medium*** priority designation indicates an issue that is a dam safety concern, for which we suggest action be taken by the City of Reading within the next two years. Items under

URS Corporation  
12420 Milestone Center Drive  
Germantown, MD 20876  
Tel: 301.820.3489  
www.urscorp.com



this category should be routinely monitored/observed. The priority may increase based upon changes in conditions.

**Low** – The **Low** priority designation indicates an issue that is a dam safety concern, for which we suggest action be taken by the City of Reading within the next three to five years. Items under this category should be routinely monitored/observed. The priority may increase based upon changes in conditions.

**Public Safety** - The **Public Safety** designation indicates a safety concern at or near the dam that was observed, but does not directly affect the safety of the dam.

**Operations & Maintenance (O&M)** – The **O&M** designation indicates a potential dam safety concern that involves routine action to be taken by the City of Reading in order for the issue to not become a dam safety issue.

Items classified as Public Safety or O&M have not been given a prioritization number, but are listed in groups by the dam.

## EXECUTIVE SUMMARY

The following summary provides an overview of the five dam sites and describes the most significant deficiencies. For a listing of all of the deficiencies please reference the individual dam assessment report for each site.

### Bernhart Dam (D06-001)-

High Priority = 3
Medium Priority = 3
Low Priority = 8
Public Safety = 5
O&M = 2

Bernhart Dam is located in Berks County, Pennsylvania approximately 1 mile north of the City of Reading and the Warren Street Bypass. The construction of the dam is estimated to have been completed around 1865 to serve as a water supply reservoir for the city. Bernhart Dam is an earthen embankment with a masonry brick core wall and a 5-foot high, masonry wall exposed at the upstream crest of the earthen embankment. The masonry brick core wall was constructed in 1896 and the masonry valve control tower on the top of the dam was built prior to 1913. The dam is approximately 180-feet long and 30-feet high at its maximum section. A 40-foot wide concrete drop spillway is located at the right abutment. The control building located on the crest of the dam contains three inoperable sluice gates that once regulated flow through two 30-inch diameter abandoned water supply lines and one 16-inch diameter, abandoned, draw-down pipe.

The primary issues identified in the dam assessment report are:

- The results of our Hydrologic and Hydraulic (H&H) study indicate that the dam is only capable of passing 24% of the Probable Maximum Flood (PMF) before overtopping of the earthen embankment occurs, which could lead to failure of the dam. The Pennsylvania Department of Environmental Protection, Dam Safety Division (PADEP



Dam Safety) categorizes the dam as a Class C (Small Impoundment) Category I Hazard (High Hazard) dam. High hazard dams are typically required to be capable of passing between 50% to 100% of the PMF, but may be less depending on the damage that would result if the dam were to fail. URS suggests that an Incremental Damage Assessment (IDA) be undertaken by the City of Reading. The results of the IDA will determine the design flood the dam must be capable of passing, and will indicate whether the existing dam is considered to be in compliance with Pennsylvania Regulations. Based upon the results of the H&H study and without an IDA, URS considers the existing primary spillway and auxiliary spillway to be inadequate.

- Bernhart Dam does not have a functioning method of drawing down the reservoir. The original construction of the dam included a 16-inch drawdown pipe and valve. Sometime prior to 1971 the valve stopped functioning and was never repaired. During the 1985 auxiliary spillway construction it is believed that the end of the drawdown pipe may have been encased in concrete. In our review of the PADEP files we have found a number of letters requesting that the drawdown pipe system be restored. URS recommends that the City of Reading comply with PADEP's request. A functioning drawdown system is needed to provide a means of drawing down the reservoir in the event a significant deficiency is suddenly discovered in the dam. A drawdown system will also allow for inspection and/or rehabilitation of structures below the water line.
- The center forebay masonry wall has recently been damaged from vegetative growth. The growth heaved a portion of wall, opening up large joints between blocks. The open joints are a pathway for water during a significant flood event, which could lead to internal erosion and subsequent failure of the dam.

Bernhart's dam is currently in relatively poor condition and no longer performs the function for which it was built, which was as a water supply reservoir. Numerous deficiencies were observed by URS and outlined within the dam assessment report. In Gannet Fleming's 2013 Inspection Report the inspector concluded that the dam in its current state "is a safety hazard and a liability to the City of Reading". The dam is classified by the state as a high hazard dam, which means the consequence of failure could result in the loss of human life and substantial economic impact. It is URS's recommendation to the City of Reading that the various recommended repair items described in the Bernhart Assessment Report be completed to restore the integrity of the dam and reduce the risk to the City. Alternatively, to reduce the City's risk, the City could consider removal of the dam and reservoir.

Removal of the dam would need to address the lead contamination on both the dam and the sediments in the reservoir. Further study will be needed to precisely estimate the economic costs associated with removal and disposal of contaminated sediment. There is also considerable



concrete and stone masonry associated with the dam including the core wall which will add substantial cost to the removal. There appears to be sufficient storage on site for the placement of non-contaminated earth and masonry from the dam as well as impounded sediments.

To minimize costs, the reno-mattress could be covered with clean fill from the earthen embankment. With the age of the dam being 150 years, there may be additional cultural resource concerns of which we are not currently aware. URS estimates the cost associated with removal of Bernhart dam to be between \$370,000 to \$820,000. See the attached detailed cost estimate and assumptions presented in Attachment D.

Bushong Mill (Tulpehocken) Dam (D06-009)-

High Priority = 1
Medium Priority = 0
Low Priority = 0
Public Safety = 3
O&M = 1

Bushong Mill Dam is located in Berks County, Pennsylvania approximately 1000 feet upstream of the confluence of the Tulpehocken Creek and the Schuylkill River at an area known as Confluence Park. The dam is currently classified by the PADEP as a Category 3 (low hazard)/Class C (small) impoundment. The dam was constructed around 1892 to provide water for hydropower to a grist mill which later became a paper mill. The Bushong Dam is constructed out of cyclopean masonry with a 135-foot spillway that is arched in the upstream direction with a 500-foot radius and is 12-feet in height. A cyclopean masonry lined channel (millrace) is located on the east side of the river that was used to convey water to the hydro-mechanical mill turbine. Upstream of the turbine was a trash screen and a feeder gate for the mill.

A number of ownership transitions occurred at the site since development. In 1961 Tulpehocken/Columbia Paper Mills sold the site to Crescent Box. In 1973 Crescent Box sold the site to Beacon Paper. In 1978 Beacon Paper sold the site to Eastern Rigging Industrial Contractors. The City of Reading took ownership of the site sometime in the 1980s through Eminent Domain as part of the city's plan to develop the riverfront area as a bike and walking trail. The City was unaware of the ownership of the dam until 2008 when Michael Zetichko from the Pennsylvania Department of Environmental Protection investigated the land transfer to the City of Reading which included the dam. The transfer is recorded in Deed Book 1818 beginning at page 684. In 2009, American Rivers began the process of exploring the removal of Bushong Mill Dam. The proposed removal of the dam was brought to a vote at the Reading City Council but was rejected. (Concern was expressed that removal of the dam might result in the fishing pier upstream of the dam no longer being over the reduced Tulpehocken Creek.)

The primary issues identified in the dam assessment report are:

- The existing upstream steel gate structure for the millrace has collapsed and now allows flow to bypass the dam through the millrace. Larry Lloyd (Berks County Conservancy)



has supplied a photograph (See the Bushong Assessment Report) from May 1, 2012 which shows 100% of the water flow bypassing the spillway and flowing through the millrace. The flow through the millrace is currently partially restricted by the aging mill turbine structure, which may collapse at some time in the future and allow for unrestricted flow through the millrace. To correct this issue the millrace should have a bulkhead added to stop flow through the millrace and force 100% of the flow over the dam. An alternatives analysis should be conducted to explore options to bulkhead the millrace.

- The site surrounding the dam contains numerous holes in the at-grade reinforced concrete slab and in the retaining wall next to the canal associated with the former mill operations. The holes create trip and fall hazards for pedestrians.

Bushong's dam is currently in fair condition, but the uncontrolled flow through the millrace and other nearby public safety issues has created an unsafe condition. The dam no longer serves the function for which it was originally constructed, which was hydro-mechanical power for mill operations. It is URS opinion that Bushong Mill dam, in its current state, is a safety hazard, a liability to the City of Reading, and should be removed. Removal of the dam alone will not address other Public Safety concerns, which should still be addressed. Alternatively, if the funds cannot be obtained to remove the dam, or until the dam can be removed, the various recommended repair items described in the Bushong Assessment Report should be completed to restore / improve the integrity of the dam, stabilize the millrace and improve the public safety around the dam. This will reduce the overall liability risk to the City.

Dam removal must consider site access which is only available from the eastern shoreline. The extent and quality of impounded sediment is unknown and may have a significant impact on the cost of removal. Any additional restoration or stabilization work upstream of the dam would require access along the Schuylkill River Park Trail. Measures to protect and/or repair the trail as needed should be considered. The dam removal would require a phased breach approach. With limited access to the dam itself, breaching would most likely occur from downstream. There is a shallow riffle below the dam but a temporary rock coffer may be required through the deeper scour pool immediately downstream of the dam. Once breaching begins, material from the dam can be used to fill the scour pool and access the remainder of the dam from the downstream location. The fate of the mill race is unknown but coordination and possibly mitigation will be required with the Pennsylvania Historic and Museum Commission. Additional coordination will also be required to address potential historic issues.

The dam removal option also has several other concerns. There is a concern about the loss of use of a handicap accessible fishing pier upstream which will likely not provide the intended recreational use after the impoundment is dewatered. A hydraulic analysis will be required to



determine the effect of dam removal on the railroad pier located 380 feet upstream of the dam and the highway bridge pier located 2,300 feet upstream. Pending the results of the analysis, additional pier scour protection may be required.

If chemical analysis of the reservoir sediments reveals no contamination, the phased breach will include measures to trap and remove sediment at the dam as it mobilizes during dewatering. One possible location for sediment disposal would be the mill race. Exposed impounded sediments will become rapidly vegetated during the normal growing season but additional seeding and mulching should be completed. If contamination is detected, more detailed measures may be required to remove and dispose of sediment appropriately. Typically if contamination is found in sediment downstream of the dam, special sediment handling is not required.

URS estimates that the cost of removing Bushong Mill Dam could be between \$320,000 and \$540,000. See the detailed dam removal cost estimate included in Attachment D.

Egelman Upper (D06-004) & Lower (D06-003) Dam-

<u>Lower Dam</u> High Priority = 6 Medium Priority = 0 Low Priority = 0 Public Safety = 3 O&M = 2
<u>Upper Dam</u> High Priority = 1 Medium Priority = 2 Low Priority = 1 Public Safety = 4 O&M = 1

The Egelman Park Upper and Lower dams are small impoundments constructed in 1900 and 1901, respectively, and are located within Egelman Park which is owned by the City of Reading. Water enters the upper reservoir through a stream to the north side of the impoundment. On the west of the impoundment is a stormwater outlet that also empties into the upper reservoir. Water flows over the upper reservoir spillway and through an underground tunnel and into the lower reservoir. The lower reservoir has an earthen embankment along the east and south faces. Water discharges over the lower reservoir spillway adjacent to Hill Road and enters a brick lined pipe near the west end of the south embankment and flows parallel to the road way for approximately 1000 feet. The pipe then crosses under Hill Road and discharges into a weir box to the south of Hill Road.

Egelman Lower Dam (D06-003) is classified by the PADEP as a Category I(High Hazard) dam and Egelman Upper Dam (D06-004) is classified as a Category III (Low Hazard Dam). Both dams are classified as Class C (Small) impoundments. Egelman Park surrounds both dam sites and is open to the public.

The dams are currently being used by the Izaak Walton League as a bass nursery. The League operates the outlet valves several times a year as part of fisheries operation. On a typical year the valves are opened on the first of September, allowing the Dam to slowly dewater over the course of the month. After fish harvesting, which is performed on the last week of September, the valves are closed allowing the Dam to refill.



The primary issues identified in the dam assessment report are:

- The results of the Hydrologic and Hydraulics study on the Lower Dam (High Hazard) indicates that the existing primary spillway is only capable of passing a 0.09PMF storm event. High hazard dams are typically required to be capable of passing between 50% to 100% of the PMF, but may be less depending on the damage that would result if the dam were to fail. URS suggests that an Incremental Damage Assessment (IDA) be undertaken by the City of Reading. The results of the IDA will determine the design flood the dam must be capable of passing, and will indicate whether the existing dam is considered to be in compliance with Pennsylvania Regulations. Based upon the results of the H&H study and without an IDA, URS considers the existing spillway at Egelman's Lower Dam to be inadequate.
- The collapsed portion of the retaining wall directly downstream of the lower dam spillway has caused one lane of Hill Road to be closed. To address this deficiency the City of Reading has engaged Gannett Fleming to prepare design drawing for repairing the retaining wall. It is our understanding that the City of Reading has contracted this work in 2014.
- A galvanized chain link fence screen was observed along the crest of the lower dam primary spillway to prevent the bass from escaping the impoundment. The fence is a dam safety issue because of the risk of debris accumulating on the fence and blocking the flow of water over the spillway. If the screen were to collapse it would likely get caught in the outlet pipe which would clog and prevent the flow of water downstream. We recommend that the chain link fence be removed from the primary spillway and, if necessary, be replaced with a properly designed boom at an appropriate distance from the spillway.
- An area of seepage was observed at the lower dam masonry wall that runs along Hill Road. The displacement of several blocks also indicates that outward dam movement may be occurring. We recommend that the movement and seepage be investigated further and remediated if necessary. To investigate the movement, a detailed stability and seepage analysis should be conducted.
- The lower dam brick masonry outlet pipe located to the south of Hill Road has several bricks missing from the bottom of the pipe. The bricks serve a critical function of load distribution in the pipe and are in need of replacement or repair. We understand this repair has been contracted by the city in 2014.



- The left abutment adjacent to the upper spillway on the upper dam has masonry deterioration which has undermined the corner of the wall at the water line and should be repaired. The deterioration could eventually lead to seepage on the downstream side of the wall. We understand this repair has been contracted by the city in 2014.

Egelman's Upper dam is currently in fair condition. The condition of Egelman's Lower dam is concerning due to the possible movement and seepage of the masonry wall along Hill Road. We recommend the City immediately engage a qualified engineering firm to investigate the stability of the earthen embankment at the lower dam. The site surrounding Egelman's dams also have a number of public safety issues which should be addressed.

URS has investigated the removal of Egelman's Upper and Lower Dam as an alternative for the City to reduce liability risk. In our opinion, the construction access is good and would require minimal disturbance of the surrounding roadway and park surfaces. The complete removal of the dam structures including underground piping would increase removal costs. Pending no contamination, the reservoir sediments can remain on-site. The stream is too small to support a fishery and phased breaching and dewatering could most likely be completed by gradual notching of the spillway or syphoning.

URS estimates that the cost of removing Egelman Upper and Lower Dam could be between \$190,000 and \$340,000. See the detailed dam removal cost estimate included in Attachment D.

#### Ontelaunee Dam (D06-350)-

High Priority = 1
Medium Priority = 1
Low Priority = 0
Public Safety = 1
O&M = 2

Ontelaunee Dam was constructed between 1927 and 1934 to create Lake Ontelaunee for supplying potable water to the City of Reading, PA. It was designed by city personnel with the help of hired consultants. Prior to the late 1980s, various agencies of the Commonwealth of Pennsylvania were responsible for permitting and other regulatory activities. For 13 years (1988 – 2000), when two hydroelectric units operated there, the dam was regulated by the Federal Energy Regulatory Commission (FERC). Following decommissioning and removal of the turbines, permitting and other regulatory activities reverted back to the Commonwealth. It is now regulated by the Division of Dam Safety, Pennsylvania Department of Environmental Protection (PADEP). The dam is owned by the City of Reading and is leased to the Reading Area Water Authority, who is the entity that is responsible for the operations and maintenance of the dam. In 2003 the dam was equipped with an automated release management system designed by BCM Engineers.

The primary issues identified in the dam assessment report are:



- A major modification to the dam is current under design by the SSM Group, Inc. involving roller compacted concrete overtopping protection, which will extend the entire length of the earthen embankment along the downstream face of Lake Shore Drive (Route 73). When the Ontelaunee Dam switched from being regulated by the FERC to the Pennsylvania DEP, the required amount of spillway flow increased to the Probable Maximum Flood. According to the hydrological analysis performed by the SSM Group, under the probable maximum flood the earthen embankment would be overtopped, creating a risk of failure of the dam. To remediate this situation SSM Group is in the process of developing plans to armor the embankment with roller-compacted concrete (RCC) to prevent a dam breach in the event of overtopping. Reportedly, the site is underlain by limestone and sinkholes have historically been observed both upstream and downstream of the earthen embankment dam. The potential for sinkhole development must be addressed in the SSM Group design. Review of the SSM Group design is beyond the scope of this study.

Ontelaunee's dam is currently in fair condition, but ultimately fails to meet the PADEP requirement for the dam to be capable of passing the Probable Maximum Flood. URS recommends the City of Reading along with the Reading Area Water Authority expeditiously complete the necessary repairs to bring the dam into compliance with PADEP requirements. URS also recommends that the various recommended repair items be completed to improve the safety and condition of the area around the dam.



**TABLE 1 – OVERALL COST SUMMARY**

Priority	Number of Items	Estimated Cost	Contingency	Sub-Total
High	12	\$800,000 <sup>1</sup>	\$240,000	\$1,040,000
Medium	6	\$140,000 <sup>2</sup>	\$42,000	\$182,000
Low	11	\$46,000	\$14,000	\$60,000
Public Safety	15	\$371,000	\$111,000	\$482,000
O&M	7	\$32,000	\$10,000	\$42,000
		\$1,389,000	\$417,000	<b>\$1,8064,000</b>

**Footnotes:**

- 1- Price does not include:
  - a. The Egelman Lower dam repairs to the collapsed portion of wall along Hill Road and the repairs to the masonry at the upper and lower dams are under contract or have been completed by the City of Reading.
  - b. Overtopping protection at Ontelaunee Dam which is currently under design by SSM Consultants.
  - c. The seepage/movement observed along the masonry wall at Egelman Lower dam will be investigated as part of the Earthen & Masonry Stability analysis listed in Priority Item No. 3 (Egelman Lower Assessment Report No. 6L). The results of this analysis will determine the price for repair.
- 2- Price does not include:
  - a. The Egelman Upper Dam repair to the collapsed portion of right downstream discharge tunnel is under contract or has been completed by the City of Reading.



**TABLE NO. 2 - HIGH PRIORITY ACTION ITEMS**

(deficiencies have been arranged in order of priority)

Priority	Site	Assessment Report Item No.	Description	Estimated Cost
1	Egelman Lower	2L	Collapsed Portion of Retaining Wall Along Hill Road	Not Priced <sup>1</sup>
2	Ontelaunee	1	Overtopping Protection	Not Priced <sup>2</sup>
3	Egelman Lower	6L	Earthen & Masonry Stability Analysis	\$80,000
4	Bernhart	1	Incremental Damage Assessment (IDA)	\$25,000
4a	Bernhart	22	Dam Modification As A Result of IDA Investigation	TBD #4
5	Egelman Lower	1L	Incremental Damage Assessment (IDA)	\$25,000
5a	Egelman Lower	12L	Dam Modification As A Result of IDA Investigation	TBD #5
6	Egelman Lower	4L	Seepage/Wall Movement Along Hill Road Repair	TBD <sup>3</sup> #3
7	Bushong	1	Uncontrolled Flow Through Millrace	\$400,000
8	Bernhart	2	Reservoir Masonry Wall Damage	\$30,000
9	Bernhart	3	Drawdown Piping System	\$200,000
10	Egelman Lower	5L	Outlet Pipe Lower Dam Masonry Repair	Not Priced <sup>1</sup>
11	Egelman Upper	1U	Left Abutment Masonry Deterioration	Not Priced <sup>1</sup>
12	Egelman Lower	3L	Spillway Trashescreen Removal & Debris Boom Replacement	\$40,000
			Sub-Total	\$800,000
			Contingency (Approx. 30%)	\$240,000
			<b>Total</b>	<b>\$1,040,000</b>

**Footnotes:**

- 1- The Egelman Lower dam repairs to the collapsed portion of wall along Hill Road and the repairs to the masonry at the upper and lower dams are under contract or have been completed by the City of Reading.
- 2- Overtopping protection at Ontelaunee Dam is currently under design by SSM Consultants and the price for construction of their design has not been estimated.
- 3- The seepage/movement observed along the masonry wall at Egelman Lower dam will be investigated as part of the Earthen & Masonry Stability analysis listed in Priority Item No. 3 (Egelman Lower Assessment Report No. 6L). The results of this analysis will determine the price for repair.



**TABLE NO. 3 - MEDIUM PRIORITY ACTION ITEMS**

(deficiencies have been arranged in order of priority)

Priority	Site	Assessment Report Item No.	Description	Estimated Cost
14	Bernhart	4	Seepage In The Left Tailrace Wall - Investigation	\$75,000
15	Bernhart	5	Earthen/Masonry Dam Stability Analysis - Investigation	\$45,000
16	Bernhart	6	Outlet Tower Structure Repair	\$15,000
17	Egelman Upper	3U	Collapsed Portion of Right Downstream Discharge Tunnel	Not Priced <sup>1</sup>
18	Ontelaunee	2	Depression on Downstream Side of Earthen Embankment	\$5,000
19	Egelman Upper	2U	Vegetative Growth Removal Along Right Earthen Embankment	Not Priced <sup>1</sup>
			Sub-Total	\$140,000
			Contingency (Approx. 30%)	\$42,000
			<b>Total</b>	<b>\$182,000</b>

**Footnotes:**

- 1- The Egelman Upper Dam repair to the collapsed portion of right downstream discharge tunnel is under contract or has been completed by the City of Reading.



**TABLE NO. 4 - LOW PRIORITY ACTION ITEMS**

(deficiencies have been arranged in order of priority)

Priority	Site	Assessment Report Item No.	Description	Estimated Cost
20	Egelman Upper	4U	Spillway Abutment Walls	COMPLETED
21	Bernhart	7	Deterioration In Mortar In Left Abutment	\$15,000
22	Bernhart	8	Damage in Reno Mattress	\$1,000
23	Bernhart	10	Upper Left Reservoir Wall Masonry Deterioration	\$15,000
24	Bernhart	9	Depression In Dam Crest Repair	\$1,000
25	Bernhart	12	Rip-Rap Movement In Reno Mattress	\$2,000
26	Bernhart	11	Right Tailrace Wall Masonry Deterioration	\$10,000
27	Bernhart	13	Abandoned Vault	\$2,000
28	Bernhart	14	Spillway Concrete Deterioration	Not Priced <sup>1</sup>
29	Bernhart	15	Scour Hole In Tailrace Channel	Not Priced <sup>1</sup>
			Sub-Total	\$46,000
			Contingency (30%)	\$14,000
			<b>Total</b>	<b>\$60,000</b>

**Footnotes:**

- 1- No repair action is currently required. The indicated item should be monitored for worsening conditions before developing a method of repair.



**TABLE NO. 5 - PUBLIC SAFETY ITEMS**

(deficiencies have not been prioritized)

Priority	Site	Assessment Report Item No.	Description	Estimated Cost
N/A	Bernhart	17	Site Security and Access	\$30,000
N/A	Bernhart	18	Dam Warning Signage	\$15,000
N/A	Bernhart	19	Walkway Bridge Handrail/Toe-Guard	\$1,000
N/A	Bernhart	20	Security Fencing at Spillway	\$5,000
N/A	Bushong	2	Fall Hazard Due To Holes In Canal Wall	\$10,000
N/A	Bushong	3	Remediate Holes In Elevated Reinforced Concrete Slab	\$150,000
N/A	Bushong	4	Control Access Onto Left Masonry Abutment	\$10,000
N/A	Egelman Lower	7L	Dam Warning Signs	\$15,000
N/A	Egelman Lower	8L	Spillway Handrail Replacement	\$10,000
N/A	Egelman Lower	9L	Security Fencing Near Spillway	\$10,000
N/A	Egelman Upper	5U	Site Stormwater System	\$60,000
N/A	Egelman Upper	6U	Wood Frame Pavilion Repairs	COMPLETED
N/A	Egelman Upper	7U	Dam Warning Signs	\$15,000
N/A	Egelman Upper	8U	Security Fencing Near Spillway	\$10,000
N/A	Ontelaunee	3	Dam Warning Signs	\$15,000
N/A	Bushong	N/A	Dam Warning Signs	\$15,000
			Sub-Total	\$371,000
			Contingency (Approx 30%)	\$111,000
			<b>Total</b>	<b>\$482,000</b>



**TABLE NO. 6 - OPERATIONS & MAINTENANCE (O&M) ITEMS**

( deficiencies have not been prioritized)

Priority	Site	Assessment Report Item No.	Description	Estimated Cost
N/A	Bernhart	16	Installation of Staff Gage	\$5,000
N/A	Bernhart	21	Animal Burrow In-Fill	\$1,000
N/A	Bushong	5	Staff Gage Installation	\$5,000
N/A	Egelman Lower	10L	Vegetation Removal at Left Embankment	\$5,000
N/A	Egelman Lower	11L	Installation of Staff Gage	\$5,000
N/A	Egelman Upper	9U	Installation of Staff Gage	\$5,000
N/A	Ontelaunee	4	Backfill Animal Burrow	\$1,000
N/A	Ontelaunee	5	Leak at Minimum Flow Pipe	\$5,000
Sub-Total				\$32,000
Contingency (Approx 30%)				\$10,000
<b>Total</b>				<b>\$42,000</b>

**LIMITATIONS**

The work on this project has been carried out in accordance with reasonable and accepted engineering practices and standard of care. No warranty or guarantee, either written or implied, is applicable to this work or the performance of the dams. The data and recommendations presented in the report are based on record information or visual observations at the time the site visits were conducted as part of this project. URS or a qualified engineering professional should be notified immediately if any changes occur in the condition of the dams from those reported in this assessment or if new information becomes available. The priorities listed may change based upon changes in conditions at the sites, which may occur rapidly, particularly with changes in reservoir level, climatic conditions or unusual loading conditions. Additionally, URS could not address conditions not present at the time the dams were observed or not readably visible through reasonable inspection efforts.

This document and information contained in this report have been prepared solely for the use of the City of Reading, PA and no third party shall have the right to rely on this report without the written consent of URS.



Final Portfolio Management Plan  
September 16, 2014  
Page 16

If you have any questions or require further regarding this letter, please contact the undersigned at your convenience.

Sincerely,

A handwritten signature in blue ink, appearing to read 'R. P. Gee'.

Ryan P. Gee, P.E.  
Senior Structural Engineer

A handwritten signature in blue ink, appearing to read 'David G. Sawitzki'.

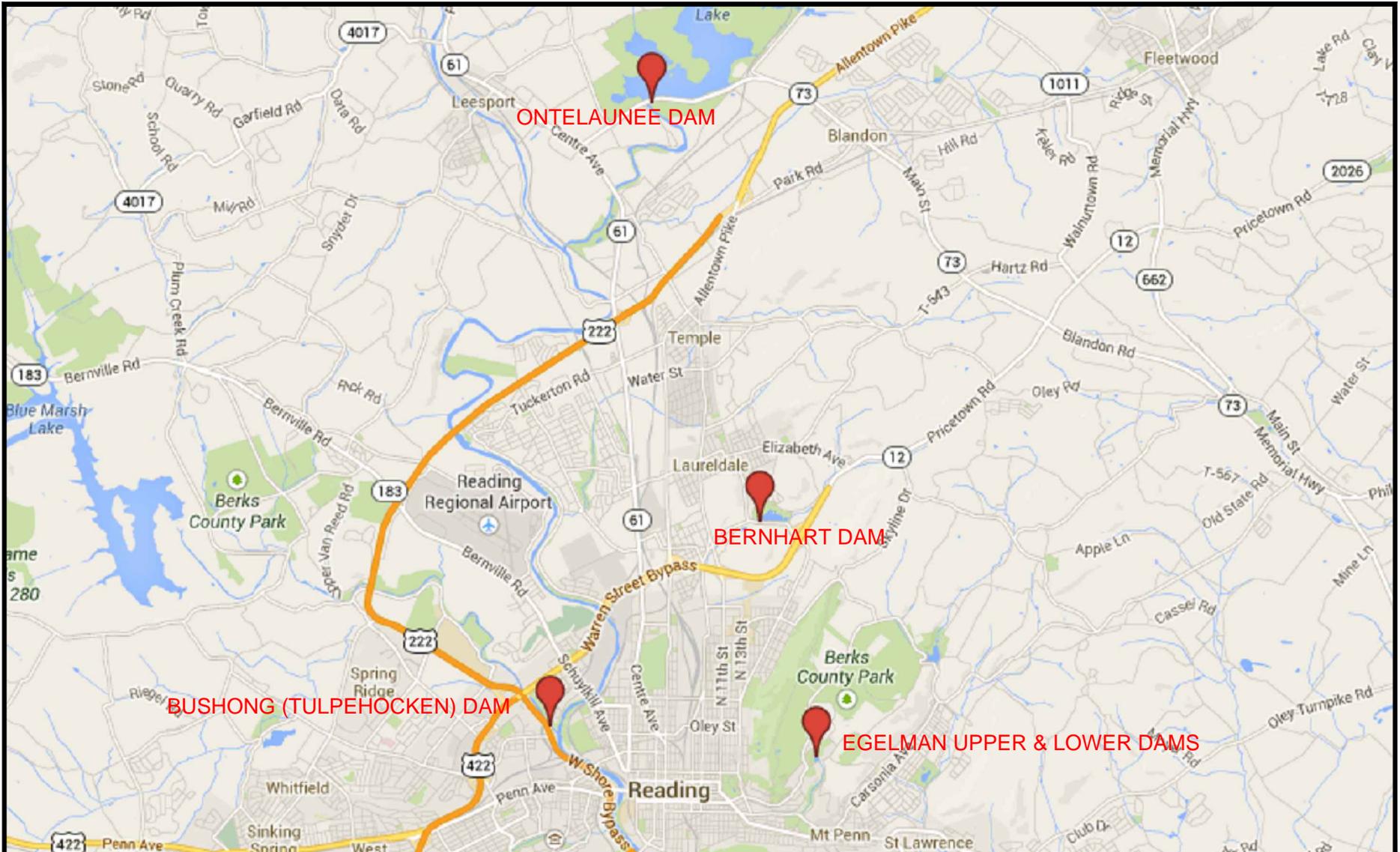
David G. Sawitzki, P.E.  
Program Manager

Attachments:

- Attachment A – Dam Location Maps
- Attachment B – Site Deficiency Maps
- Attachment C – Dam Summary Sheets
- Attachment D – Dam Removal Cost Estimates

# Attachment A

Dam Location Maps

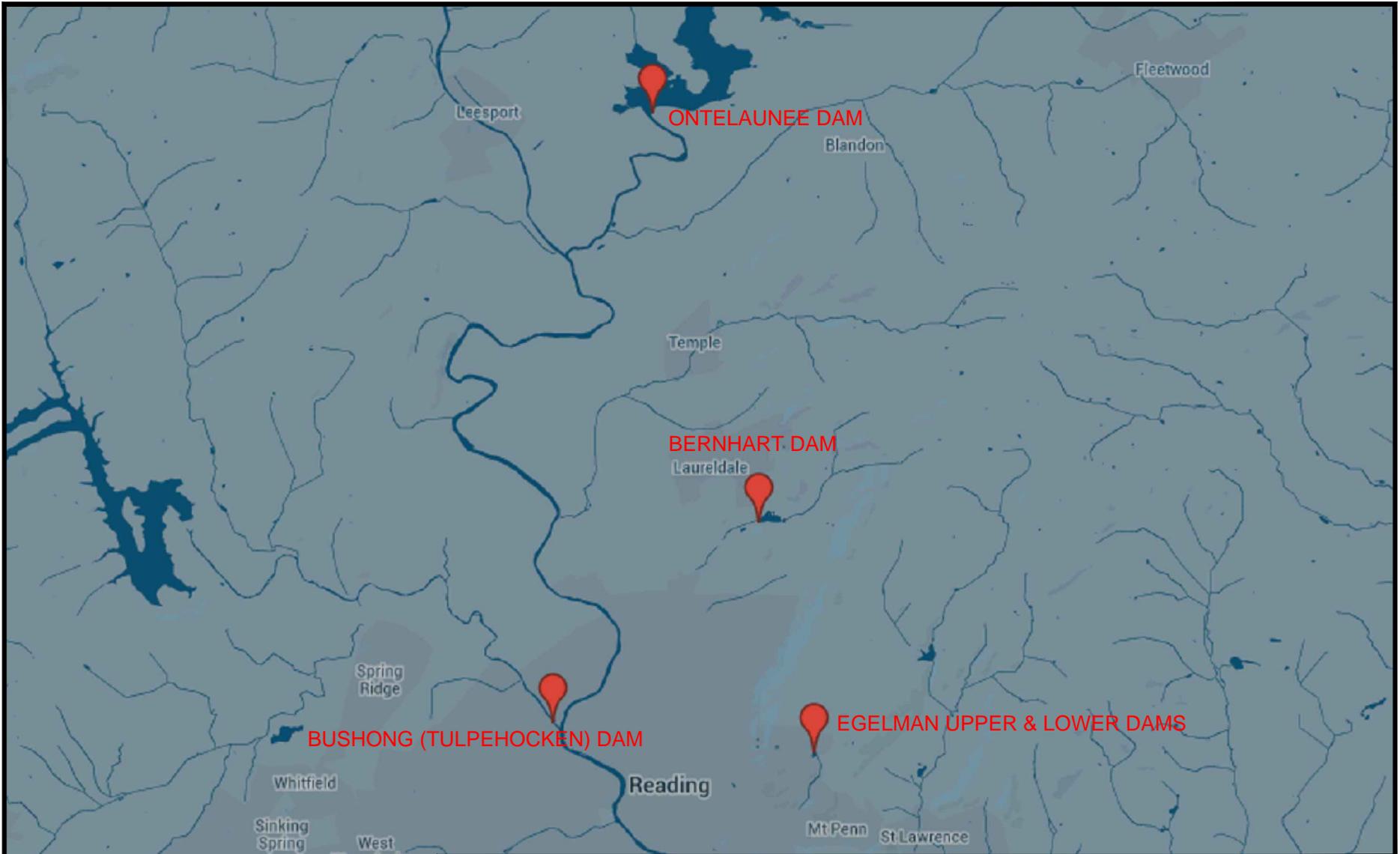


CLIENT: CITY OF READING, PA – PUBLIC WORKS DEPARTMENT			
PROJ: DAM CONDITION ASSESSMENT			
	ENGINEER	RPG	

TITLE **READING DAMS**



PROJ NO 15303807  
FIGURE **FIG-1**

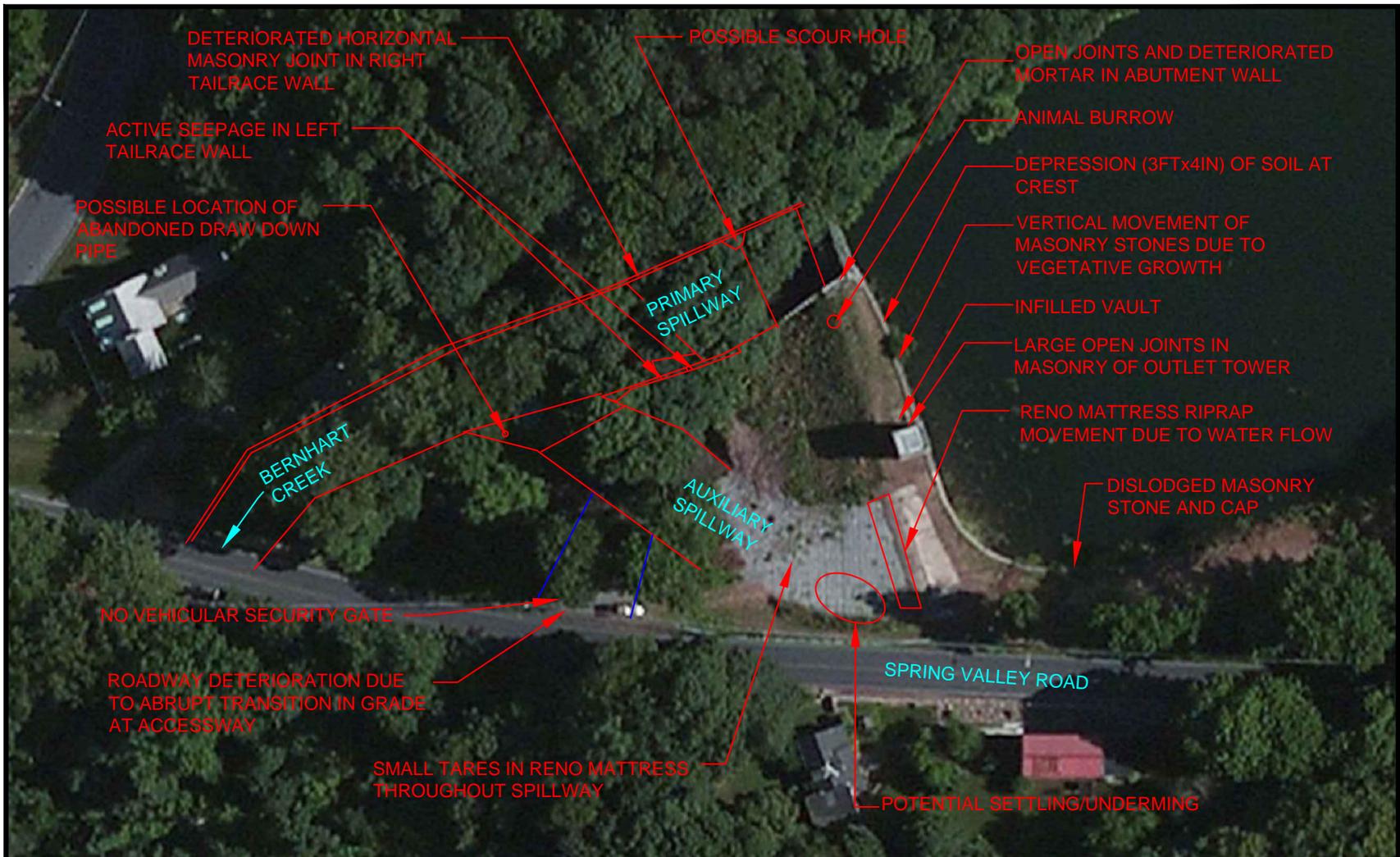


CLIENT: CITY OF READING, PA – PUBLIC WORKS DEPARTMENT			
PROJ: DAM CONDITION ASSESSMENT			
	ENGINEER	RPG	

TITLE	READING DAMS
<b>URS</b>	
PROJ NO	15303807
FIGURE	FIG-2

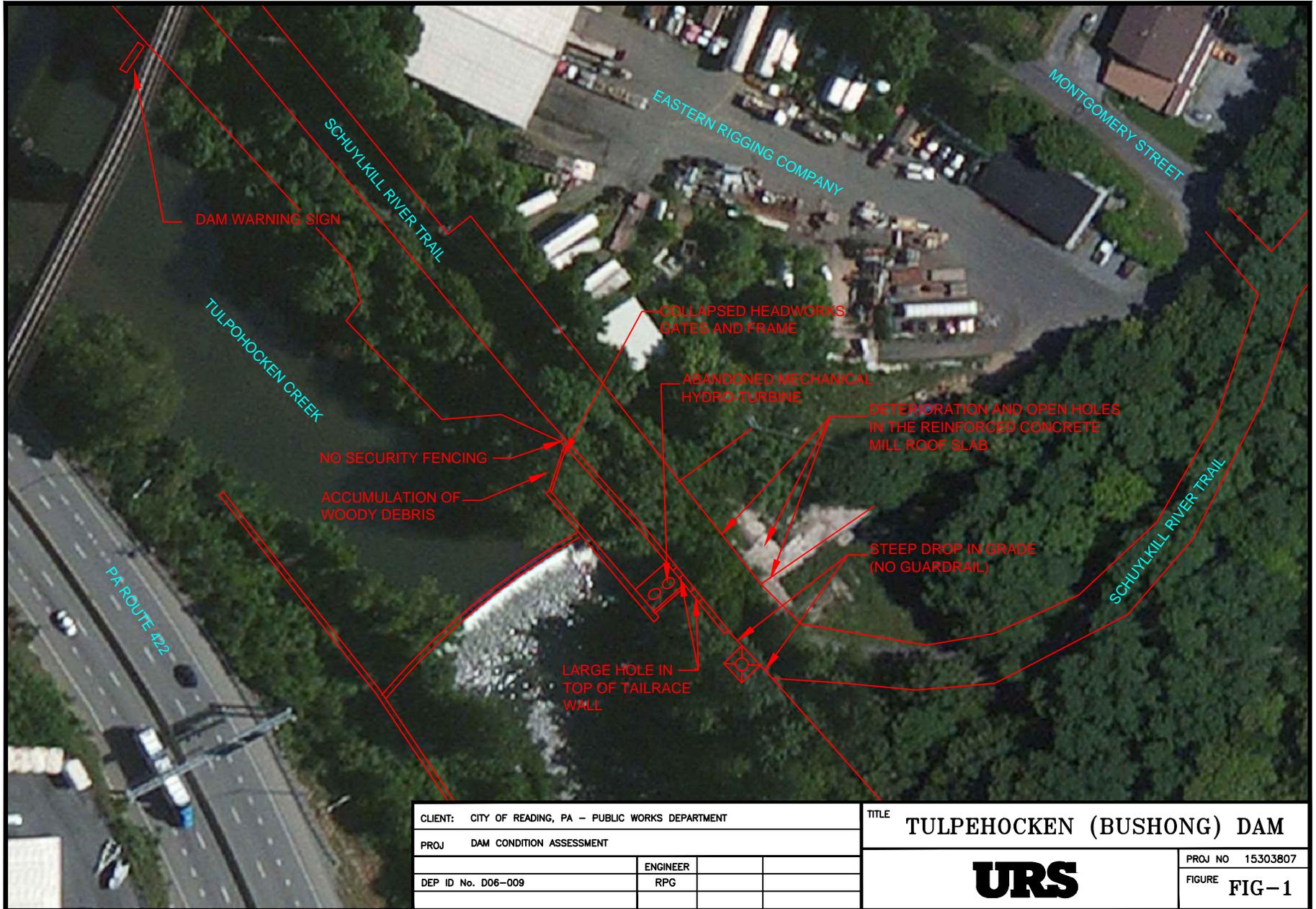
# Attachment B

Site Deficiency Maps



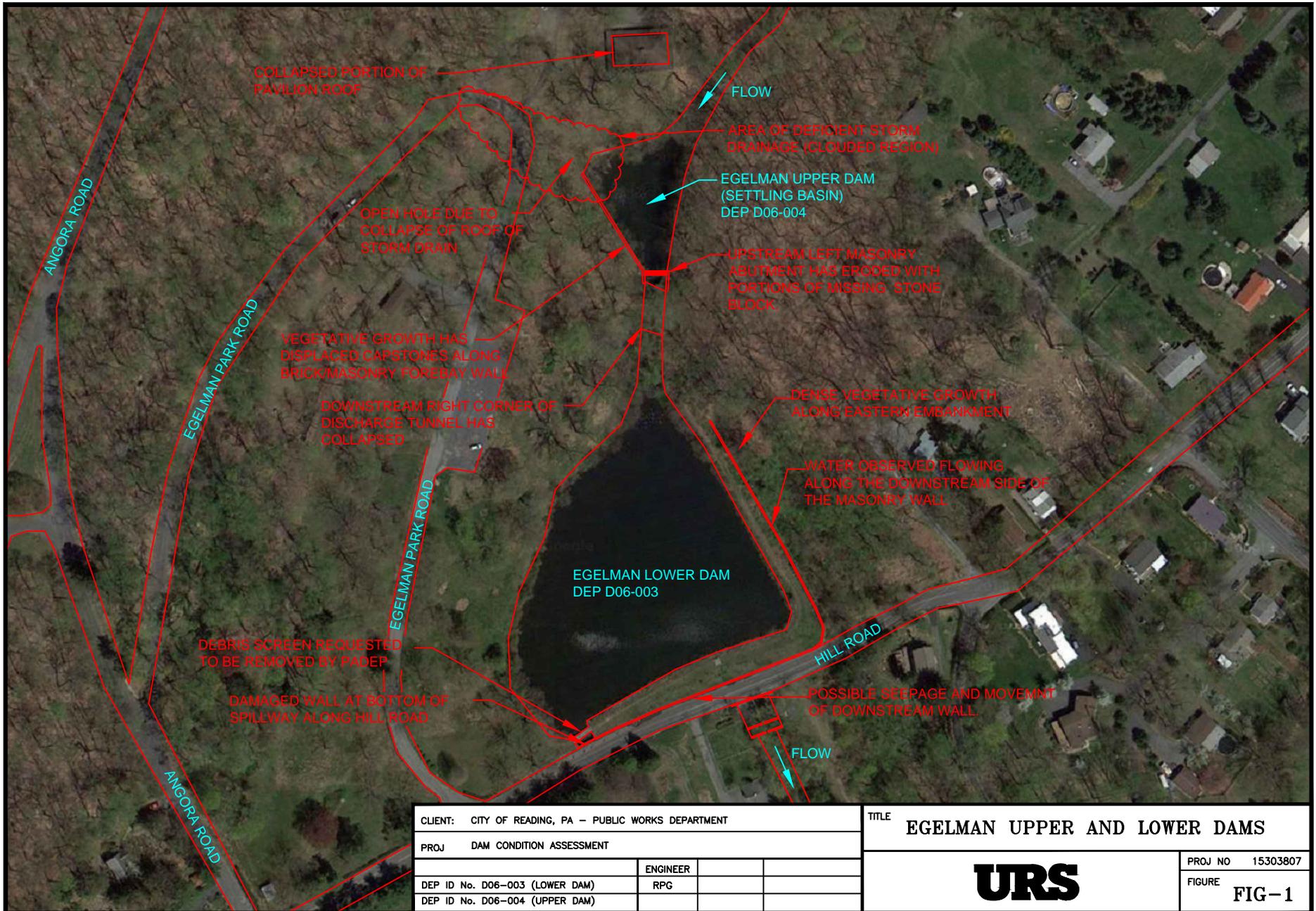
CLIENT: CITY OF READING, PA – PUBLIC WORKS DEPARTMENT			
PROJ DAM CONDITION ASSESSMENT			
DEP ID No. D06-001	ENGINEER	RPG	
PA ID No. PA-717			

TITLE <b>BERNHART DAM</b>		PROJ NO 15303807
<b>URS</b>		FIGURE <b>FIG-1</b>



CLIENT: CITY OF READING, PA - PUBLIC WORKS DEPARTMENT	
PROJ DAM CONDITION ASSESSMENT	
DEP ID No. D06-009	ENGINEER RPG

TITLE <b>TULPEHOCKEN (BUSHONG) DAM</b>	
<b>URS</b>	
PROJ NO 15303807	FIGURE <b>FIG-1</b>



CLIENT: CITY OF READING, PA – PUBLIC WORKS DEPARTMENT	
PROJ DAM CONDITION ASSESSMENT	
DEP ID No. D06-003 (LOWER DAM)	ENGINEER RPG
DEP ID No. D06-004 (UPPER DAM)	

TITLE <b>EGELMAN UPPER AND LOWER DAMS</b>	
<b>URS</b>	PROJ NO 15303807
	FIGURE <b>FIG-1</b>



LAKE ONTELAUNEE

LAKE SHORE DRIVE (ROUTE 73)

OUTLET BUILDING

TRASHRACKS

POSSIBLE LEAK BETWEEN OUTLET PIPE AND CONCRETE WALL

LOCATION OF OBSERVED RODENT BURROW

LOCATION OF DISPLACED STONE MASONRY STEP

CLIENT: CITY OF READING, PA – PUBLIC WORKS DEPARTMENT			
PROJ DAM CONDITION ASSESSMENT			
DEP ID No. D06-350	ENGINEER RPG		

TITLE LAKE ONTELAUNEE – SPILLWAY	
<b>URS</b>	PROJ NO 153
	FIGURE FIG



LAKE ONTELAUNEE

EARTHEN EMBANKMENT DAM

SEE FIGURE-2  
FOR PRIMARY SPILLWAY

LOCATION OF OBSERVED  
DEPRESSION/WET AREA

CLIENT: CITY OF READING, PA – PUBLIC WORKS DEPARTMENT	
PROJ: DAM CONDITION ASSESSMENT	
DEP ID No. D06-350	ENGINEER RPG

TITLE LAKE ONTELAUNEE – OVERVIEW



PROJ NO 15303807  
FIGURE FIG-1

# Attachment C

Dam Summary Sheets

**URS DAM INFORMATION SUMMARY WORKSHEET**

**DAM NAME: Bernhart Dam - DEP No. 06-001**

<b>HISTORY</b>	
Year Built / Modified	Original Dam c. 1865 Masonry Core Wall c. 1896 Masonry Gate House c. 1913 Auxiliary Spillway and Channel Repairs c. 1985
Modifications Made	Addition of an Auxiliary Spillway (1985)
Existing Reports	2013 Bernhart Annual Dam Inspection – Gannet Fleming
Date Last Inspected	November 6, 2013
Issues Raised	From the 2013 Annual Inspection: <i>“In its current state, Bernhart Dam is a safety hazard and a liability to the City of Reading due to the numerous deficiencies observed. Gannett Fleming recommends that the City of Reading take appropriate action to correct the deficiencies or alternatively, breach the dam.”</i>  Refer to the 2013 Annual Dam Inspection Report For Issues Raised.
<b>DAM INFORMATION</b>	
Dam Type / Hazard	Size – Class C / Hazard – Category 1
Crest Elev. / Normal Pool	Primary Spillway Crest Elev. 385.7ft Auxiliary Spillway Crest Elev. 387.0ft Normal Pool 385.7ft
Height / Length	Primary Spillway - Height 30ft / Length 180ft
Slopes	
Seepage Controls	Four weepholes in left wall of principal spillway channel.
Drainage	
Foundation Conditions	
Instrumentation	None
<b>SPILLWAY INFORMATION</b>	
Type / Location	Stone Masonry
Primary Crest Elev.	385.7
Primary Crest Length	180ft
Channel Length	Approx. 330ft
Capacity	129 acre-feet (Normal Storage)
Spillway Design Flood	
Aux. Crest Elev.	387.0ft
Aux. Crest Length	60.0ft

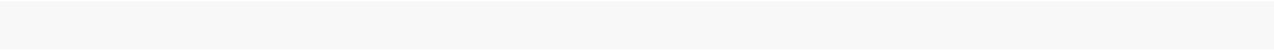


<b>OUTLET WORKS</b>	
Tower	No Info
Conduit	No Info
Gates and Valves	No Info
Drawdown	No Info
<b>OTHER</b>	

**URS DAM INFORMATION SUMMARY WORKSHEET**

**DAM NAME: Bushong Mill (Tulpehocken) Dam - DEP No. 06-009**

<b>HISTORY</b>	
Year Built / Modified	c. 1892 (estimated)
Modifications Made	
Existing Reports	2010 Dam Inspection Report 2003 Dam Inspection Report (5-Year Inspection)
Date Last Inspected	June 14, 2010
Issues Raised	Primary gates to abandoned mill are in poor condition and need of repair. Tree/Debris on spillway. Masonry channel needs repaired. Vegetation on the right abutment should be removed.
<b>DAM INFORMATION</b>	
Dam Type / Hazard	Size – Class C / Hazard – Category 3
Crest Elev. / Normal Pool	207.08 (1892 Datum)
Height / Length	Height 12ft (Spillway) / Length 135ft (Spillway)
Slopes	
Seepage Controls	
Drainage	
Foundation Conditions	
Instrumentation	
<b>SPILLWAY INFORMATION</b>	
Type / Location	Stone Masonry
Primary Crest Elev.	207.08 (1892 Datum)
Primary Crest Length	135ft
Channel Length	
Capacity	
Spillway Design Flood	
Aux. Crest Elev.	
Aux. Crest Length	
<b>OUTLET WORKS</b>	
Tower	None
Conduit	None
Gates and Valves	To the left side of the main spillway a gate structure has collapsed, leaving only the rusted iron frame tilting upstream and gathering debris.
Drawdown	Not functional



<b>OTHER</b>	

**URS DAM INFORMATION SUMMARY WORKSHEET**

**DAM NAME: Egelman’s Lower Dam – DEP No. 06-003**

<b>HISTORY</b>	
Year Built / Modified	c. 1901
Modifications Made	
Existing Reports	2013 Annual Inspection Report 2012 Annual Inspection Report
Date Last Inspected	December 31, 2013
Issues Raised	Poor masonry condition. Failed stone masonry wall (Repair Design By Gannet Fleming) Sediment in Forebay Refer to 2013 Report For Numerous Additional Issues Raised
<b>DAM INFORMATION</b>	
Dam Type / Hazard	Size - Class C / Hazard - Category 1
Crest Elev. / Normal Pool	EL. 693.4ft
Height / Length	Varies along Hill Road. Approximately 15ft.
Slopes	Varies
Seepage Controls	None
Drainage	Draw-down valve located along southern embankment.
Foundation Conditions	Unknown
Instrumentation	Settlement Monitoring Installed Along Crest
<b>SPILLWAY INFORMATION</b>	
Type / Location	Masonry. South Embankment.
Primary Crest Elev.	EL. 693.4ft
Primary Crest Length	Verify In Field
Channel Length	Varies
Capacity	Unknown
Spillway Design Flood	Unknown
Aux. Crest Elev.	None
Aux. Crest Length	None
<b>OUTLET WORKS</b>	
Tower	In-Ground Vault
Conduit	Steel Outlet Pipe
Gates and Valves	
Drawdown	Draw-down occurs annually for fish harvesting.
<b>OTHER</b>	

**URS DAM INFORMATION SUMMARY WORKSHEET**

**DAM NAME: Egelman’s Upper Dam – DEP No. 06-004**

<b>HISTORY</b>	
Year Built / Modified	c.1901
Modifications Made	
Existing Reports	2013 Annual Inspection Report of Egelman’s Lower (D06-003) 2010 5-Year Inspection Report
Date Last Inspected	December 31, 2013 (As part of the 2013 Lower Inspection)
Issues Raised	Vegetative Growth. Abutment Masonry Deterioration Stormwater System
<b>DAM INFORMATION</b>	
Dam Type / Hazard	Size - Class C / Hazard - Category 3
Crest Elev. / Normal Pool	
Height / Length	
Slopes	Varies
Seepage Controls	None
Drainage	Single Drawdown Pipe
Foundation Conditions	Unknown
Instrumentation	None
<b>SPILLWAY INFORMATION</b>	
Type / Location	Masonry
Primary Crest Elev.	Unknown
Primary Crest Length	Field Verify
Channel Length	200ft +/-
Capacity	Unknown
Spillway Design Flood	Unknown
Aux. Crest Elev.	None
Aux. Crest Length	None
<b>OUTLET WORKS</b>	
Tower	None
Conduit	Located in center of spillway.
Gates and Valves	Single valve with lock located at the center of spillway
Drawdown	Drawdown occurs annually as part of the fish harvest.
<b>OTHER</b>	

**URS DAM INFORMATION SUMMARY WORKSHEET**

**DAM NAME: Ontelaunee Dam – DEP No. 06-350**

<b>HISTORY</b>	
Year Built / Modified	Original Construction 1926
Modifications Made	Height Raised 1935
Existing Reports	2012, 2011, 2010 Annual Inspection Reports Phase 1 Inspection Report (Yellow Cover) May 1978
Date Last Inspected	October 15, 2013
Issues Raised	2012 Inspection Report Stated “Overall condition of the dam is good” <ul style="list-style-type: none"> <li>• Remove sediment from gallery floor to provide unobstructed draining through the 4 horizontal drains.</li> <li>• Continue to clean out the 10 vertical pressure relief pipes and the 4 horizontal drains once a year.</li> </ul>
<b>DAM INFORMATION</b>	
Dam Type / Hazard	Size - Class B / Hazard - Category 1
Crest Elev. / Normal Pool	Elev. 304.0
Height / Length	Height = 51ft / Length = 543.5ft
Slopes	
Seepage Controls	
Drainage	Vertical Pressure Relief Pipes & Horizontal Drain
Foundation Conditions	
Instrumentation	Ground monitoring wells
<b>SPILLWAY INFORMATION</b>	
Type / Location	Concrete Ogee
Primary Crest Elev.	294.0 (May 1978 Datum)
Primary Crest Length	543.5ft Total (507.5ft minus piers)
Channel Length	150ft Wide Downstream Channel Bed
Capacity	½ PMF. Beyond 1/2PMF overtopping of embankment occurs (Ref: Phase 1 Report)
Spillway Design Flood	
Aux. Crest Elev.	
Aux. Crest Length	
<b>OUTLET WORKS</b>	
Tower	Pump-House.
Conduit	(3) 48” diameter pipes used for water supply.
Gates and Valves	Pump house contains (1) 48” diameter pipe valve for blow-off, and spillway contains valves for (4) 36” diameter drawdown pipes.



Drawdown	Emergency drawdown system (1) 48" DIA pipe and (4) 36" DIA pipes.
<b>OTHER</b>	

# Attachment D

Dam Removal Cost Estimates

**PROJECT:** **BERNHART DAM REMOVAL**  
 7-23-15; Corrections made to spreadsheet to formulas for estimate totals  
 Drainage area 2.8 square miles  
 Embankment earthen with concrete core  
 Construction Access good  
 sediment quality poor possible lead contamination

<b>LOW</b>			
<b>DESIGN</b>	<b>Quantity</b>	<b>Unit</b>	<b>Cost/unit Cost</b>
Survey (includes bathymetry)	1	LS	\$20,000.00 \$20,000
sediment characterization	1	LS	\$2,000.00 \$2,000
Design	1	LS	\$25,000.00 \$25,000
Permitting	1	LS	\$8,000.00 \$8,000
Cultural resources	1	LS	\$2,000.00 \$2,000
bid doc prep	1	LS	\$6,000.00 \$6,000
<b>SUBTOTAL</b>			<b>\$63,000</b>

<b>CONSTRUCTION</b>			
Mobilization/Demob.	1	trip	\$10,000.00 \$10,000
Clear and grub for access	1	LS	\$2,000.00 \$2,000
Dewatering	3	months	\$10,000.00 \$30,000
concrete demolition and disposal	200	CY	\$100.00 \$20,000
earthen embankment removal	1000	CY	\$8.00 \$8,000
sediment removal and placement on site	500	CY	\$12.00 \$6,000
Final grading and site stabilization	14	acre	\$4,000.00 \$56,000
Stream restoration	1600	FT	\$50.00 \$80,000
construction management	1	LS	\$30,000.00 \$30,000
<b>SUBTOTAL</b>			<b>\$242,000.00</b>

**CONTINGENCY** 20% **\$61,000.00**

**TOTAL \$366,000.00**

**SAY \$370,000.00**

<b>HIGH</b>			
<b>DESIGN</b>	<b>Quantity</b>	<b>Unit</b>	<b>Cost/unit Cost</b>
Survey (includes bathymetry)	1	LS	\$25,000.00 \$25,000
sediment characterization	1	LS	\$4,000.00 \$4,000
Design	1	LS	\$35,000.00 \$35,000
Permitting	1	LS	\$12,000.00 \$12,000
Cultural resources	1	LS	\$4,000.00 \$4,000
bid doc prep	1	LS	\$8,000.00 \$8,000
<b>SUBTOTAL</b>			<b>\$88,000</b>

<b>CONSTRUCTION</b>			
Mobilization/Demob.	1	trip	\$16,000.00 \$16,000
Clear and grub for access	1	LS	\$4,000.00 \$4,000
Dewatering	6	months	\$10,000.00 \$60,000
concrete demolition and disposal	400	CY	\$100.00 \$40,000
earthen embankment removal	4000	CY	\$8.00 \$32,000
sediment removal and disposal offsite	1000	CY	\$60.00 \$60,000
Final grading and site stabilization	14	acre	\$6,000.00 \$84,000
Stream restoration	1600	FT	\$100.00 \$160,000
construction management	1	LS	\$40,000.00 \$40,000
<b>SUBTOTAL</b>			<b>\$496,000.00</b>

**CONTINGENCY** 40% **\$233,600.00**

**TOTAL \$817,600.00**

**SAY \$820,000.00**

Assumptions (costs not included):  
 No utilities  
 Clean vs contaminated sediment considered in cost estimates  
 On-site disposal & capping vs. offsite disposal considered in cost estimate  
 Some level of cultural resource documentation will be required  
 No T&E species of concern  
 LiDAR used for base plan  
 No other infrastructure improvements included (ie roadway)  
 earthen embankment can be disposed of with breached impoundment  
 Partial vs. full dam removal  
 sediment volumes are estimated  
 Does not include pumped bypass

**PROJECT:**

7-23-15; Corrections made to spreadsheet to formulas for estimate totals  
 Drainage area 218 square miles  
 Dam construction Masonry 150' long x 12' high  
 Construction Access fair

**BUSHONG DAM REMOVAL**

	Quantity	Unit	LOW Cost/unit	Cost
<b>DESIGN</b>				
Survey (includes bathymetry)	1	LS	\$20,000.00	\$20,000
sediment characterization	1	LS	\$2,000.00	\$2,000
Design	1	LS	\$25,000.00	\$25,000
Permitting	1	LS	\$8,000.00	\$8,000
Hydraulic analysis	1	LS	\$15,000.00	\$15,000
Cultural resources	1	LS	\$5,000.00	\$5,000
bid doc prep	1	LS	\$6,000.00	\$6,000
<b>SUBTOTAL</b>				<b>\$81,000</b>
<b>CONSTRUCTION</b>				
Mobilization/Demob.	1	trip	\$10,000.00	\$10,000
Clear and grub for access	1	LS	\$2,000.00	\$2,000
concrete demolition and disposal (mill)	200	CY	\$100.00	\$20,000
Dam removal ( includes temporary rock coffer)	1	LS	\$80,000.00	\$80,000
sediment removal and placement on site	500	CY	\$12.00	\$6,000
Final grading and site stabilization	3	acre	\$5,000.00	\$15,000
bank stabilization	1	LS	\$10,000.00	\$10,000
Bridge pier rock protection	1	LS	\$10,000.00	\$10,000
construction management	1	LS	\$30,000.00	\$30,000
<b>SUBTOTAL</b>				<b>\$183,000.00</b>
<b>CONTINGENCY</b>		20%		<b>\$52,800.00</b>
<b>TOTAL</b>				<b>\$316,800.00</b>
<b>SAY</b>				<b>\$320,000.00</b>

	Quantity	Unit	HIGH Cost/unit	Cost
<b>DESIGN</b>				
Survey (includes bathymetry)	1	LS	\$ 30,000	\$30,000
sediment characterization	1	LS	\$ 2,000	\$2,000
Design	1	LS	\$ 35,000	\$35,000
Permitting	1	LS	\$ 12,000	\$12,000
Hydraulic analysis	1	LS	\$ 20,000	\$20,000
Cultural resources	1	LS	\$ 7,000	\$7,000
bid doc prep	1	LS	\$ 8,000	\$8,000
<b>SUBTOTAL</b>				<b>\$114,000</b>
<b>CONSTRUCTION</b>				
Mobilization/Demob.	1	trip	\$ 16,000	\$16,000
Clear and grub for access	1	LS	\$4,000	\$4,000
concrete demolition and disposal (mill)	400	CY	\$100	\$40,000
Dam removal ( includes temporary rock coffer)	1	LS	\$100,000	\$100,000
sediment removal and disposal offsite	500	CY	\$60	\$30,000
Final grading and site stabilization	6	acre	\$6,000	\$36,000
Bank stabilization	1	LS	\$15,000	\$15,000
Bridge pier rock protection	1	LS	\$20,000	\$20,000
construction management	1	LS	\$ 40,000.00	\$40,000
<b>SUBTOTAL</b>				<b>\$301,000.00</b>
<b>CONTINGENCY</b>		30%		<b>\$124,500.00</b>
<b>TOTAL</b>				<b>\$539,500.00</b>
<b>SAY</b>				<b>\$540,000.00</b>

Assumptions (costs not included):

- No utilities
- Contaminated vs. clean sediment considered in cost estimate
- On-site disposal vs. offsite disposal considered in cost estimate
- Some level of cultural resource documentation will be required
- No T&E species of concern
- LIDAR used for base plan
- No other infrastructure improvements included (ie roadway)
- stone masonry dam will be used to fill downstream scour pool
- full dam removal with possible remnants for historic interpretation
- Does not include pumped bypass
- No metal reinforcement in dam
- Potential for other dam to appear couple hundred feet upstream of dam
- Does not address safety issue with remaining underground vaults and millworks

**PROJECT: ENGLEMAN DAM REMOVAL (Upper and Lower combined)**

7-23-15; Corrections made to spreadsheet to formulas for estimate totals

Drainage area 0.6 square miles  
 Embankment earthen  
 Construction Access good

DESIGN		Quantity	Unit	LOW	
				Cost/unit	Cost
Survey		1	LS	\$ 8,000	\$8,000
sediment characterization		1	LS		\$0
Design		1	LS	\$ 15,000	\$15,000
Permitting		1	LS	\$ 5,000	\$5,000
Cultural resources		1	LS		\$0
bid doc prep		1	LS	\$ 5,000	\$5,000
<b>SUBTOTAL</b>					<b>\$33,000</b>

CONSTRUCTION		Quantity	Unit	Cost/unit	Cost
Mobilization/Demob.		1	trip	\$ 3,000	\$3,000
Clear and grub for access		1	LS	\$2,000.00	\$2,000
concrete demolition and disposal		50	CY	\$100.00	\$5,000
daylight stream between ponds		150	FT	\$150.00	\$22,500
Remove Dam embankment on site		13500	CY	\$2.00	\$27,000
sediment removal and placement		200	CY	\$12.00	\$2,400
Final grading and site stabilization		3.5	acre	\$4,000.00	\$14,000
Stream restoration		700	FT	\$50.00	\$35,000
construction management		1	LS	12000	\$12,000
<b>SUBTOTAL</b>					<b>\$122,900.00</b>

**CONTINGENCY** 20% **\$31,180.00**

**TOTAL \$187,080.00**

**SAY \$190,000.00**

DESIGN		Quantity	Unit	HIGH	
				Cost/unit	Cost
Survey		1	LS	\$ 10,000	\$10,000
sediment characterization		1	LS	\$ 2,000	\$2,000
Design		1	LS	\$ 20,000	\$20,000
Permitting		1	LS	\$ 10,000	\$10,000
Cultural resources		1	LS	\$ 5,000	\$5,000
bid doc prep		1	LS	\$ 7,000	\$7,000
<b>SUBTOTAL</b>					<b>\$54,000</b>

CONSTRUCTION		Quantity	Unit	Cost/unit	Cost
Mobilization/Demob.		1	trip	\$ 6,000	\$6,000
Clear and grub for access		1	LS	\$4,000	\$4,000
concrete demolition and disposal		100	CY	\$100	\$10,000
daylight stream between ponds		150	FT	\$200	\$30,000
Remove Dam embankment on site		13500	CY	\$3.50	\$47,250
sediment removal and placement		500	CY	\$12	\$6,000
Final grading and site stabilization		3.5	acre	\$6,000	\$21,000
Stream restoration		700	FT	\$100	\$70,000
construction management		1	LS	12000	\$12,000
<b>SUBTOTAL</b>					<b>\$206,250.00</b>

**CONTINGENCY** 30% **\$78,075.00**

**TOTAL \$338,325.00**

**SAY \$340,000.00**

Assumptions (costs not included):

- No utilities
- No T&E species of concern
- LiDAR used for base plan
- No other infrastructure improvements included (ie roadway)
- earthen embankment can be disposed of within breached impoundment
- full dam removal
- sediment volumes are estimated
- Does not include pumped bypass
- sediments are suitable for disposal on site (i.e., not contaminated)