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May 21, 2010

Mr. Joseph Sawyer, City Manager & Dam Committee  
City of Corunna  
402 North Shiawassee Street  
Corunna, MI 48817

Subject: May 7, 2010 Meeting with Dam Committee

Dear Mr. Sawyer and Respected Dam Committee Members:

This letter will serve as a summary of our discussion on May 7, 2010. My April 20, 2010 working draft memo (MEMO) that compiled information regarding the Corunna Dam (Dam) was reviewed at the meeting. The information was obtained from the City of Corunna (City) and from documents obtained by the City under the Freedom of Information Act (FOIA) from the Dam Safety Program, Land & Water Management Division, Michigan Department of Natural Resources & Environment (Department) Land, the City's files and public website, a review of Michigan's Dam Safety Law, Part 315 of the Natural Resources and Environmental Protection Act (NREPA) of 1994 as amended (Part 315), and my observations of the Dam.

This memo is organized in sections titled Summary, Background, Findings, Options, and Recommendations. Each section contains comments, opinions, facts and questions. The questions may need to be answered by the Department before the City proceeds with decision(s) on the disposition of the Dam.

We agreed that various options and decisions, by either party, will lead to different consequences for the Department, City, and the general public. The City and Department must both meet its Public Trust responsibilities under Part 315. We agreed that initial contacts with the Department need to follow a written path, until common goals are agreed to, and a solid working relationship by written agreement develops between the City and Department. This letter provides a proposed guideline to facilitate a decision making process for both the City and Department.

## **SUMMARY**

In my opinion, the Dam is both structurally and hydraulically in poor condition. The structurally poor condition, which is typical of a rock filled timber crib with a concrete cap Dam, is a concern to the Department, regardless of its hazard potential classification. The fact that the Dam maintains an impoundment level; even though, it cannot effectively control flow over or through it, raises Dam safety concerns. If the Dam has a partial or complete structural failure during either flood or low flows, the potential danger to the downstream floodplain areas is minimal to none. This is the crux of the issue with the Dam. No clear defined failure mode(s) that leads to a delineated impacted area downstream has been presented to the City in past Dam safety inspection REPORTS. As noted in the attached Department's letter dated August 26, 1974 (1974 Department Letter), written by Mr. Leon A. Cook, P.E., Mr. Cook found "...under

flood flow conditions, a failure of the dam is not likely to significantly increase downstream flood stages and thereby be the direct cause of any downstream property damage.” Failure of the Dam has been and will be progressive. The Department concluded in 1974 “..this dam cannot be considered to be in good repair, we do not consider its condition to be hazardous.” A partial dam failure would not be hazardous to downstream areas. Mr. Cook goes on to state: “...it will be eventually reduced to a pile of rubble.” I share Mr. Cook’s observations and conclusions.

## **BACKGROUND**

The City and Department are both responsible to protect the public health, safety and welfare of the residents. Part 315 requires both the City and the Department to take into account environmental factors impacted by Dam operations and maintenance. Therefore, it is paramount that the City and Department reach common goals to ensure that the Public Trust is addressed. Sharing common goals should provide a good working relationship within a framework of trust. Proposed goals include the following:

- Protection of the public interest.
- Common sense approach to allocation of limited public resources and funding schemes.
- Ability to work together by respecting each others limitations provided under the law and funding capabilities.
- Development of a consensus decision making process that leads to a win-win scenario for both parties.

My MEMO included a summary of findings during my review of letters, memos, dam safety inspection reports, Department permits, plans, available email and documents provided on the City’s website. This review revealed limited data and facts. In my opinion, neither accurate nor sufficient information was used to facilitate discussions, past decisions, or decisions yet to be made. It is hoped that dialogue can lead to clarification and consensus decision(s) on the disposition of the Dam.

In short, decisions by the City and the Department, and the impact of those decisions, should be thoroughly understood by each party as it serves the public’s interest.

## **FINDINGS**

The MEMO contains specific details, comments, opinions and questions related to each document and reports reviewed, and the applicable portions of Part 315 that serves as a basis for the Department’s actions and inactions regarding the Dam.

Information exchanged between the Department and the City may be lacking due to insufficient documentation between both parties. Discussion on Hazard Potential Classification, Dam Safety Inspection Reports, the Department Order, and Miscellaneous Findings/Concerns include the following:

### **Hazard Potential Classification**

First, it is understood that the existing significant hazard potential classification may need to be changed to low, or at a minimum, better documentation is needed to support the existing classification that is on file with the Department. It is discussed here because it was cited in the

present Department Order.

The 1974 Department Letter to the City found the Dam, even in its poor condition at that time, not to be hazardous. As the result, the City purchased the Dam with the understanding that it would not pose a significant liability. The Department in 1979, under the National Dam Safety Program (NDSP), inventoried Dams throughout Michigan and assigned a “hazard potential classification” based on the potential impact to downstream areas should the Dam fail for whatever reason. The hazard potential rating was documented in a form titled “Hazard Potential Evaluation”. A “significant” hazard potential rating was assigned by a consultant that was under contract with the Department. A failure to review the 1974 Department letter is clearly evident because a “low” hazard potential classification was clearly implied. (As a Department employee in the Dam Safety Unit at that time, I was aware that each individual file on Michigan Dams was not reviewed when the Dam inventory data was compiled, which included the assignment of hazard potential classifications. The Department reviewed the form completed by the consultant without a file review.) The City has made claims that no change in downstream floodplain areas has occurred since 1974.

Subsequently, passage of Part 315 in 1990 utilized the hazard potential classifications from the NDSP and added environmental considerations. Although the Department is responsible under Part 315 for review and establishment of hazard potential classifications, limited staffing results in a review only when questioned in dam safety inspection reports.

Based on the above, there is a need to clearly document the basis for the hazard potential classification. The Dam may be justified as a “low” hazard potential classification based on the following:

- Since 1974, no written downstream floodplain review documentation exists that may change the hazard potential rating within any of the Dam safety inspection reports.
- My review of the City’s Flood Insurance Study (FIS) and preliminary hydraulic calculations indicate that there is no significant effective head during flood conditions. If failure occurs during a flood, the flood wave is expected to be less than 1.75 feet at the Dam and would rapidly dissipate as it moves downstream.
- The Emergency Action Plan (EAP) lacks clear guidance identification of impacted downstream areas that would direct emergency services personnel during a potential failure of the Dam.

#### **Dam Safety Inspection Reports**

Dam Safety Inspections and Reports under Part 315 were done for the City by the Department in 1997, 2001, and 2009. SME and Capitol Consultants did the engineering and structural evaluations in 2001 as recommended by the Department, and Spicer Group, Inc. did the 2005 inspection and Report.

In my opinion, all of the reports:

- Did not provide any further documentation to support the existing hazard potential

classification. They only provided a statement that existing “significant” hazard potential rating was adequate.

- The inspection reports should have included photographs of the downstream area to document potential impacts.
- The reports should have utilized the FIS for flood elevations at estimated flood flows from various Dam failure scenarios.
- Provided insufficient hydraulic documentation, either by lack of supporting calculations or spillway rating tables, to evaluate the spillway capacity of the Dam. They only made a statement that the spillway capacity was sufficient, which was referenced to the previous report.
- Lacked any structural stability calculations/evaluation of the structure. In fact, the 2001 engineering evaluation only made statements of its poor condition, but did not provide stability calculations requested by the DEQ in the 2001 Report recommendations. Further, the 2005 Report, provided no definitive statement on whether the Dam is stable, and there was no recommendation for a stability analysis to be done, even though further structural “investigation” was recommended.

Each report provided numerous photographs. However, the photos are neither referenced to previous reports nor taken from the same perspective. This makes it difficult to monitor any changes to the Dam’s structural condition. My review of the photographs found that none of the photographs between the Reports would have indicated any significant change in the previous 1974 “poor” condition rating of the overflow spillway section. Only the stop log section, leading to the subsequent 2006 repair of bracing the abutment and training walls, is documented. There is a need to develop a sound photographic numbered document that notes condition changes over time to allow for objective review and justification for actions to either repair or remove the structurally failing portions of the Dam.

In my opinion, with each Report, the Department did not utilize Part 315 to direct the City in a more affirmative process. As an example, in the 2005 Report, the Department did not utilize Part 315 to order any further investigations. Either the Department did not have the opinion that the Dam was in danger or it did not possess a “danger” to the Dam or public. I find discussion in the Reports to justify the basis for order or action, i.e. either Department Order to Alleviate Danger, Order to Remove, Orders of Emergency, or the City to use its Emergency Drawdown provision provided under Sections 31518, 31519, 31521 and 31520 of Part 315.

Based on the Department’s 2009 Report and conclusions, there does not appear to be an emergency condition or urgency to take action. There is no definitive statement within the Report that conditions “... if left uncorrected, could lead to the failure of the Dam.” This is required under the Administrative Rules for Part 315, specifically R281.1310(2)(b)(iii), and could be the basis for an Department Order. Conditions can either be structural or hydraulic (spillway capacity) deficiencies. In addition, the 2009 Report did make a definitive statement on the spillway adequacy. Other comments to the 2009 Report include the following:

1. The statements “continue planning”, “continue monitoring”, “remove vegetation” leads one to believe that the status quo of the structural condition was okay to the

Department Dam safety inspector, Mr. Pawloski, P.E.,

2. There are no statements on whether previous inspection report recommendations have or have not been done. There is discussion of the 2006 permitted repairs to the stoplog section. The repair included bracing of the walls and sinkhole repair.
3. Again, there is no documentation of downstream area impacts to support a significant hazard potential classification and there are no downstream photographs.

In my opinion, the 2009 Report discusses a “progressive failure” of the Dam. Part 315 does not define “progressive failure.” It does define a “failed dam” and “failure.” Because the Dam maintains an impoundment level, it has not failed and failure implies an incident of an uncontrolled release of water. This has not happened, therefore, there is no failure to act upon.

### **Department Order**

In a letter dated December 4, 2009, the Department directed the City to draw down the impoundment under a “department order,” citing its authority under Section 31518(7), based on the Department’s 2009 Report. This Report was dated October 12, 2009 with a field inspection date of August 28, 2009. Clearly over three months had elapsed that implied no sense of urgency or emergency condition exists.

A department **order under this section of Part 315 does not provide for an Administrative hearing or review**. However, per this cited section, the Department had to order a draw down if it believes that action would alleviate a danger “**based on the findings and recommendations of the report**”.

**In my opinion, the Report’s findings and recommendations state poor condition, progressive failure, but recommendations do not identify an immediate danger. The recommendations are clear in direction to the City to “continue” planning and monitoring of the Dam.** This may raise procedural questions under Part 315 for the Department to address. Did the Department:

1. Evaluate the specific impacts that a drawdown would cause to both the impoundment and downstream environments? Please note Part 315 requires environmental assessments, for major actions at a dam, and the administrative rules direct only a downstream evaluation.
2. Conduct its own internal review on potential wetland and sediment transport issues before issuing this Order?
3. Consider how a drawdown would affect the need for adequate energy dissipation through the existing stop log section?
4. Calculate the change in impoundment level fluctuations in a drawdown state that results in restricted flows through the stoplog section and evaluate the potential impacts to both the impoundment and Dam structure?
5. Evaluate the potential detrimental impact to the remaining timber cribbing from repeated wetting and drying cycle frequencies under drawn down impoundment levels?

6. Consider that a drawdown action may accelerate and exacerbate the "...progressive failure" to a more structural failure that may result in downstream impacts?
7. Conduct a simplified Dam break analysis to determine downstream impacts to property, residences, and natural resources? Such an analysis would be beneficial to update the Emergency Action Plan (EAP).
8. If no was answered to any of the above, why did the Department not order the City, as provided for in Section 31518(6), for a more "...detailed investigation or evaluation..."? This section may have been added by the legislature as an additional step so either the Department's report or a consultant's report would not be self serving to result in actions upon a dam owner.

### **Miscellaneous Findings/Concerns**

Since our May 7, 2010 meeting, I have again reviewed the file, updated the MEMO, compared photographs from the 1997, 2001, 2005 and 2009 Reports, completed preliminary spillway flow capacity calculations both with and without stop logs in place, and made calculations on flows impacting storage volumes. The following is a summary of my findings:

1. Drawdown of the impoundment and permanent removal of the stop logs may have significant detrimental impacts to the Dam and impoundment and downstream areas.
  - a. In the drawn down state, flow through the existing stop log section will cause a more frequent and rapid change in impoundment levels. With stop logs removed and based on the mean monthly exceedance flows provided by Department, the impoundment is estimated to fluctuate 2.6 feet for flows between 120 cubic feet per second (cfs) to 720 cfs. If stop logs remain in place, this fluctuation is 0.6 feet.
  - b. A drawdown will concentrate higher flows through the already braced stoplog section. The potential for rapid deterioration of the existing walls and the undermining of the abandoned powerhouse flume area is readily apparent. Also, the potential to exacerbate the loss of soil behind the right spillway abutment wall is a concern. The temporary sinkhole repairs done in 2006 appear again to be an issue.
  - c. Flows will not have adequate energy dissipation. The downstream section will need to be modified to protect from erosive velocities. Possibly, very large well-graded riprap on top of a geotextile fabric may be needed. Riprap in itself is not a designed energy dissipator. Stone size could range up to 2 or more feet in diameter, which must be well graded in placement, and is dependent on water depth and flow velocity in this area.
  - d. Drying and wetting of exposed timber crib will accelerate deterioration leading to an increased potential for failure of the timber crib. This timber crib support the concrete cap. This can lead to rapid loss of crib stone material, further openings and uncontrolled flow through the crib material. Maintenance of an impoundment level may not be possible.

2. Structural Condition: No significant change to the “poor” structural condition of the overflow spillway (main spillway section) since 1974 is documented. The only change is in the right spillway abutment of the stop log section. The bracing of the stop log bays walls in 2006 and the temporary fill of the sinkhole addressed that concern.

However, drawdown may exacerbate further soil loss in the area, and there is evidence that active soil loss along the right spillway abutment wall is occurring. The positive move to acquire the private property adjacent to this area will facilitate access to the dam for future disposition decision implementation.

3. Hazard potential classification: needs further documentation with a possible change from Significant to Low hazard potential classification. This reevaluation is based on the following:

- a. The initial classification did not consider the Department 1974 letter on file.
- b. Since 1974, no documentation of downstream floodplain elevations over a range of flood flows exists. This information is needed to identify structure(s) within the floodplain.
- c. No detailed dam break analysis for various failure scenarios has been documented. However, in my opinion, a detailed analysis would be costly and not provide any additional information for a disposition decision process. My review of the existing FIS indicates no significant effective head difference between impoundment and tail water during flood conditions exist. (i.e. if the Dam failed during a flood, no significant downstream flood wave would be generated). An estimated 1.75 feet of effective head exists during flood conditions.
- d. Based on the above, the Dam, in its current condition, does not appear pose a threat to public health, safety and welfare. The Department should substantiate whether a danger exists to the Dam or to the public.
- e. The 17 acre reported impoundment area has little storage volume on a flashy high flow stream. Therefore, no big flood wave even during low flow or sunny day dam failure mode is expected.

4. Partial removal of Dam eliminates Part 315 regulation. Partial removal would require the remaining portion of the Dam to impounds no more than 5 acres (or influence more that 5 acres of backwater) during the 1% chance (100-year) flood event. Several methods to achieve this are possible, and include vertical or horizontal removal of a portion of the Dam.

5. Hydraulic capacity of the Dam is inconsistent reported and the lacks of documentation of the spillway capacity. The Dam inventory indicates the spillway capacity of 3700 cfs based on the 1979 inventory. The dam safety inspection reports state the Dam has the capacity to pass the 200-year flood flow of 6800 cfs with five

feet of flow over Dam. Calculations to back these statements were not provided in the Department or Consultant Reports and are not in the FOIA documents obtained from the Department's file.

Preliminary calculations produced a capacity of approximately 6600 cfs to an elevation equal to the top of the right abutment with the stoplogs removed, and a capacity of approximately 5380 cfs with stoplogs left in. The elevation of the left abutment is unknown. However, the 2001 SME report indicated the left abutment could be 2 feet lower than the right abutment,

Clearly, **the Dam may not have sufficient spillway capacity** or appears to be hydraulic deficient.

### **OPTIONS**

Since 2001, The City has hired consultants to provide proposed repair and removal options and cost estimates at that time. These include, but are not limited to:

1. Repair:
  - a. 2001 Estimate: \$850,000.
  - b. Rapids via rock and stilling pools: 2006 Estimate by Dr. Sandy Verry was \$700,000 to \$1,400,000.
  - c. Steel Sheet piling and Concrete: 2006 Estimate by Spicer Group, Inc. was \$616,000.
2. Repair by alteration:
  - a. Roller Compacted Concrete (RCC): 2006 Estimate by Spicer Group, Inc. was \$254,000 - \$337,000.
3. Partial Removal: 2001 Estimate was \$450,000.
4. Removal: 2001 Estimate was \$750,000.
5. New Dam: 2001 Estimate was \$1,800,000.

To cease operation and maintenance, i.e. abandonment as defined and allowed for under Part 315, is an additional option. This option was not presented to City by either the Department or the Consultants. This option allows the City and the Department to keep the impoundment drawdown until a final disposition decision is reached. It puts the Public on notice that the City is addressing any potential danger to the Dam or to the public (identified by the Department.) It allows the City to retain its ownership and move on to any final disposition of the Dam it may decide upon. Estimated costs are minimal and include a permit application fee and man-hours to prepare the application. The application could be prepared by staff and a licensed professional could review statements, plan or schedule required by the Department.

### **RECOMMENDATIONS**

The following recommendations are in order of priority:

1. Immediately address the current Department Order for Drawdown by sending a

letter requesting clarification and an agreement on how to proceed with the drawdown. **Clarify that the City does not need a permit to proceed with drawdown.** Request the Department to respond to questions raised on the impacts a drawdown may have on the Dam structure, potential sediment transport, potential impact on upstream emergent wetlands, and the time span or length of the drawdown. Request the Department to conduct an evaluation and provide documentation to support the existing “significant” hazard potential classification. Such an evaluation will assist in the updating of the Emergency Action Plan required under Part 315.

Develop a schedule as required by the Department Order and suggest the following:

- a. Raise funds for repair or removal options or allow a special interested third party to intervene.
  - b. Establish **annual** photograph documentation on portions of the Dam to evaluate and monitor structural condition changes. Photographs can be taken by City personnel and reviewed by a licensed professional engineer who will evaluate them and make comments to the Department.
2. The City should file a Part 315 permit application to abandon the Dam. Following the Department’s Order for drawdown requires the removal of the stop logs. Likewise, the State should not require a formal permit application process for this since it is not a requirement of Part 315. Part 315 clearly requires the Department to take affirmative action to protect the public and natural resources within reasonable limits. This drawdown Order takes away any “operation” component for the Dam by the City. Since the City does not have either the funds or means to continue operation and maintenance of the structure, abandonment appear to meet definition in Part 315 and the associated procedural options.
  3. The City should advise both upstream riparians and City residences that the purpose of the Dam is solely recreational. Past surveys of the public indicates a small percentage of locals actually use this recreation component. If the impoundment is to be maintained, the property values along the impoundment can be protected legally by establishing a “normal lake level” under Part 307 (Inland Lake Level) of NREPA. The City could pass a resolution to direct upstream riparian owners interested in maintaining the impoundment level to follow the procedures under Part 307. This requires them to directly petition the Shiawassee County Board of Commissioners for the establishment of a normal lake level upstream of the Dam. It also implies the creation of a Special Assessment District for those directly benefited for the continue operation and maintenance of the Dam. However, if such proceedings are initiated, the City should cooperate by either transferring ownership of the dam to a public entity (County) or by signing an operation maintenance agreement.

Procedures to establish the normal lake level and confirm the Special Assessment District boundaries by the Court can be provided by the Department or by this consultant. This allows for those directly impacted to be part of long range planning and part of the potential funding to maintain the Dam either by reconstruction, repair, or alteration. Please be aware the Department may provide a position paper to the Court during the hearing establishing a normal lake level.

4. The City should advise special interest groups and the Department that if they intend to alter, repair, or remove the Dam, construction of white water rapids, and/or provide fish passage, that the City is willing to sell the Dam and its flowage rights to that special interest, provided that public access to the river and impoundment area by City residences is maintained.
5. If the Department does not grant an abandonment permit, another option exists where the City no longer pays property taxes. The Dam will revert to the State of Michigan, similar to the Shiawassee Town Dam. This may require a review of the hazard potential classification by the State if the Dam is "drawdown by Order."
6. If the final disposition of the dam is removal, the City should request from the Department to define limits for removal so that the Dam does not meet the size criteria under Part 315. In my opinion, this would include removing a portion of the Dam so that it impounds no more than 5 acres (or influences more than 5 acres of backwater) during the 1% chance (100-year) flood event.

Again, thank you for the opportunity to serve you. If you have any questions, please contact me.

Sincerely,



Gary F. Croskey, P.E.

GFC: