UPPCO's January 4, 2018 revised report based upon a January 4, 2018 telephone conversation with MDEQ and MDNR request of January 4, 2018

Dead River Hydroelectric Project

Three Year Test Period – Test Year Four Final Annual Report (2016-2017)

Upper Peninsula Power Company

Test Year Four (2016-2017) Report Contents:

Attachments:

INTRODUCTION

Per the Article 405 "*Operations Monitoring Plan*" required by the License issued October 4, 2002, as amended January 24, 2006 and September 1, 2011, Upper Peninsula Power Company (UPPCO) is required to conduct a three-year test period on its Dead River Hydroelectric Developments. The test period is conducted to determine UPPCO's ability to comply with the provisions of Articles 402, and 403 of the License. Additionally, UPPCO shall provide copies of the annual report to the Federal Energy Regulatory Commission (FERC) within four (4) months of completion of a testing year[1].

In the Year Three Testing Report filed with the FERC on December 5, 2016, UPPCO proposed to conduct a fourth year of testing due to the unavailable storage in Silver Lake Storage Basin (SLSB) during the 2016 summer season. On January 31, 2017, the FERC approved the recommendation. Therefore, UPPCO is providing this report for the fourth year.

Prior to submittal of the report to FERC, UPPCO must provide copies to the Michigan Department of Environmental Quality (MDEQ), Michigan Department of Natural Resources (MDNR), and the United States Fish and Wildlife Service (USFWS). The report must contain the following information:

- Hourly operations data for reservoir elevations and total plant flows at each development
- A description of any deviations from operational requirements
- A summary of any anomalies in operations
- A summary of the four (4) years of operations testing
- Recommendations to modify project operations to achieve compliance as necessary

HOURLY DATA FOR RESERVOIR HEADWATER ELEVATION AND TOTAL PLANT FLOWS

Hourly data for each testing year's operation of the Dead River Hydroelectric Project is provided as both a graphical representation, as well as given in tabular format provided in the attached table. The data is provided in terms of hourly headwater elevation data (ATTACHMENT A) and hourly total plant flow data (ATTACHMENT B). It should be noted that sharp" spikes" in the data typically portray a plant outage, which are reported as either

[1] "Testing Year" is the timeframe determined by the FERC upon UPPCO's fulfillment of the Silver Lake Storage Basin Refill Plan. This window has been declared as being annually August 5 to August 4 of the following year

individual planned or unplanned deviations (greater than 60 minutes), or they are provided in the annual deviations report (less than 60 minutes).

There are occurrences of missing data in the record. Each area of missing data has a note attached that indicates why the data is not presented. In most cases, data has been deliberately removed because it is obviously errant data where rapid changes in elevation are not physically possible. The errant data has been removed to provide for an accurate graphical display. However, during the period on or about February 14, 2017, data is missing because UPPCO was implementing its own independent operating system during this time-period and was separating itself from the operating system of its former parent company Integrys. Therefore, there were lapsed periods where data is not available.

Fulfillment of license requirements:

UPPCO filed its report titled "2016 Annual Report – Operation Monitoring & Report of Deviations Less Than Sixty Minutes" with FERC on February 28, 2017. The report outlines all deviations within the 2016 operating year, per Articles 402 and 403 of the License.

The 2016 operating year had three (3) deviations less than 60-minutes and five (5) deviations 60-minutes or greater. None of the deviations reported in the 2016 annual report were a result of UPPCO's inability to comply with requirements of the License. The figure below was provided as a table in the annual deviation report to FERC, and provides a summary of all deviations at each Development on the Dead River Project:

Figure 1. 2016 Dead River annual deviation summary

Deviations < 60 Minutes				
Project	Date	Length	Deviation	Reason
McClure	01/12/2016	14 Minutes	Minimum Flow	Unit trip due to packing adjustment
McClure	02/23/2016	11 Minutes	Minimum Flow	Unit trip due to packing adjustment
McClure	02/23/2016	16 Minutes	Minimum Flow	Unit trip due to continued packing adjustments

Deviations > 60 Minutes				
Project	Date	Length	Deviation	Reason

Hoist[2]	03/17/2016	1 Hr 11 Mins	Minimum Flow	Local weather storm caused plant electrical fault
McClure	03/17/2016	1 Hr 10 Mins	Minimum Flow	Local weather storm caused plant electrical fault
McClure	08/01/2016	16 days	Minimum Flow	Part 12 inspection and concrete repairs
Hoist	10/15/2016	1 Hr 43 Mins	Minimum Flow	Plant trip due to high winds
McClure	11/07/2016	1 Hr 50 Mins	Minimum Flow	Plant trip due to bearing cooling water line plug
Hoist	12/25/2016	2 Hr 7 Mins	Minimum Flow	Oil pump belt failure

UPPCO has observed and reported seven (7) deviations 60-minutes or greater within the 2017 operating year prior to August 5, 2017. Two of the deviations were planned

Deviations.
Five of the deviations were due to weather events. One of the planned deviations was conducted to allow UPPCO to meet the May start of month target elevation of 1341.0 feet NGVD at the Dead River Storage Basin (DRSB)[3]. Table 1 provides a summary of all deviations greater than 60 minutes in the 2017 operating year.

It should be noted, the SLSB was refilled and resumed normal operation on May 10, 2017.

Table 1. 2017 Summary of deviations greater than 60 minutes

Development	Date	Length	Deviation	Reason
Hoist	01/16/2017	14 days	Target Elevation	Hold Reservoir Constant for Ski Marathon
McClure	01/20/2017	1 Hr 30 Mins	Minimum Flow	Local weather storm caused plant electrical fault
Hoist	03/07/2017	1 Hr 12 Mins	Minimum Flow	Local weather storm caused plant electrical fault

[2] The Hoist Facility impounds the Dead River Storage Basin.
[3] The May start of month target of 1341.0 feet NGVD was proposed in the Year Three Test Report submitted to the Commission on December 5, 2016.

Hoist	03/17/2017	21 days	Target Elevation	Planned deviation to achieve 1341.0 feet NGVD-May Start of Month Target
Hoist	04/10/2017	2 days and 12 Hrs	Minimum Flow	Local weather storm caused plant electrical fault
McClure	04/10/2017	> 1 day and < 1 day	Minimum Flow and Headwater	Local weather storm caused plant electrical fault
McClure	04/22/2017	19 days	Headwater	High Inflow due to weather

Deviations that are less than 60 minutes will be included in the 2017 annual report to be sent to the agencies for review and comment by the end of January.

MODIFICATIONS TO OPERATION THAT WERE IMPLEMENTED AS PART OF THE TEST PERIOD

UPPCO proposed several operational deviations in the 2013-2014, 2014-2015, 2015-2016, and 2016-2017 test reports. These were implemented to comply with the provisions of Articles 402, and 403 of the License. The provisions that were implemented and recommendations for future operations are listed by development as follows:

Silver Lake Storage Basin:

1. Adjustment of the start of month target elevation for May, June, and July at SLSB to the top of the spillway 1485.2 feet NAVD 88 or 1485.04 feet NGVD[4] was implemented. An adjustment of the May and June start of month target elevation was implemented in the 2014-2015 season and an adjustment of the June and July start of month target elevation was implemented in the 2015-2016 and 2016-2017 season.

Dead River Storage Basin:

1. A meeting in February or early March in 2014, 2015, 2016, and 2017 was arranged by UPPCO for consultation with the resource agencies (MDEQ, MDNR, and USFWS), and stakeholders (Dead River Campers Inc. (DRCI) and Keweenaw Bay Indian Community) to discuss UPPCO's suggestions to alter the DRSB operations prior to Spring runoff. This discussion included altering operations based on snowpack depth and water equivalency, as well as weather predictions.

2. An adjustment of the start of month target for the month of May was implemented in 2014, 2015, 2016, and 2017. The target was modified from 1340.0 feet NGVD to an elevation of 1341.0 or 1342.0 feet NGVD in 2014. The target was modified from 1340.0 feet NGVD to an elevation of 1341.0 feet NGVD in 2015 and 2017. In 2016, the target was modified to 1342.0 or 1343.0 feet NGVD because SLSB could not provide storage for the DRSB because it was in a drawn down state.

[4] The elevation of the top of the spillway was verified as 1485.20 feet NAVD-88 or 1485.04 feet NGVD during the 2017 dam safety inspection. Since the elevations are listed in the license in NGVD, an elevation of 1485.04 feet NGVD will be utilized.

3. UPPCO requested to eliminate the start of month target elevations for March and April for the 2017 season, but after consultation with the MDNR and MDEQ, it was believed to be premature and the request was withdrawn.

McClure Basin:

1. For the 2017 season, the maximum elevation of 1196.4 feet NGVD (spillway crest elevation) was eliminated.[5] This elevation proved difficult to attain when wave action or excess water due to storm events or runoff caused water to be spilled. In addition, Article 405 requires UPPCO to release flushing flows over the spillway. In 2017, UPPCO operated the McClure Storage Basin at or above 1194.8 feet NGVD, with no maximum reservoir elevation, while limiting fluctuations in elevation of not more than one (1) foot/day.

[5] Elimination of the maximum reservoir elevation at the McClure Basin was proposed in the Year Three Test Report submitted to the Commission on December 5, 2016.

SUMMARY OF FOUR YEARS OF OPERATIONS TESTING

Silver Lake Storage Basin:

1. Start of month targets

- If Spring runoff cannot be captured in the system, it is very difficult to meet the reservoir elevation requirements at the DRSB during the summer recreation season.
- During the recreation season, the operation of the SLSB is based upon the water input needs to the DRSB.
- The water needs of the DRSB during most years, require the SLSB to provide storage after spring runoff and during the recreation season.
- The current start of month target elevations for the SLSB beginning at spring runoff and ending with the end of the summer recreation season will not allow for enough storage in the SLSB to maintain the start of month target elevations at the DRSB during the summer recreation season.
- It has been demonstrated through the test period, by adjusting the start of month target elevations at SLSB to 1485.04 feet NGVD (top of spillway) for June and July, it is beneficial to maintain the start of month elevations within the DRSB for the summer months by adjusting the start of month target elevations at SLSB to 1485.04 feet NGVD for June and July.
- It is difficult to determine the onset of spring runoff each year. In 2014, and 2015, spring runoff began in very early April[6]. In 2016[7] and 2017 spring runoff began in March.
- The April start of month target elevation influences operational decisions on flow releases in March (because striving to achieve a start of month target elevation is implemented in March) and consequently during the potential period when spring runoff can begin.
- In the summer of 2017, UPPCO was forced to release water from the SLSB to strive to meet the August start of month target elevation of 1480.0 while the DRSB was above its target of 1341.0.
- The start of month target elevations at the SLSB for the months of May through September need to be modified.

[6] The 2014 and 2015 runoff is determined by viewing the graph contained in Year One and Year Two Test Reports.
[7] Since the elevation of Silver Lake Storage Basin in 2016 was held low, the start of runoff for the area has been determined by looking at the flows for the USGS gage on the Middle Branch of the Escanaba River at Humboldt (USGS Gage No. 04057800).

- The start of month target elevations for November through March provide a benefit to limit reservoir fluctuations during freezing conditions to minimize impact upon hibernating reptiles.
- The monthly minimum elevations provide a benefit by assuring SLSB is not unduly impacted by drawdowns to meet the start of month target elevations at the DRSB.
- There is a need to maintain minimum flow releases from the SLSB even if the start of month target elevations or the minimum elevations cannot be maintained.
- The storage of colder water in the SLSB for release throughout the summer is believed to benefit water quality downstream during the early and late summer months.

Dead River Storage Basin:

1. Consultation

- Precipitation in the form of snow or rain (when it melts and how it melts) is a major driving factor in the operation of the Dead River System (primarily the SLSB and the DRSB).
- If proper decisions are not made in the winter prior to spring runoff, the start of month target elevations may not be met during the summer recreation season or the elevation of the DRSB can rise well above the target elevation during spring runoff.
- If spring runoff cannot be captured in the system, it is very difficult to meet the reservoir elevation requirements at the DRSB during the summer recreation season.
- Consultation with all stakeholders in February or early March is necessary for all stakeholders to understand the difficulty of predicting how and when spring runoff will occur. This reduces criticism by stakeholders during the summer recreation season.

2. May start of month target

- Spring runoff during the test period has occurred prior to the second part of April.
- If the start of month target for May is not increased to 1341.0 feet NGVD, spring runoff cannot be stored in the DRSB to its maximum potential for the summer recreation season.
- With a May start of month target of 1340.0 feet NGVD, UPPCO would be forced to release water downstream to drive the elevation down to the target of 1340.0 feet NGVD and the elevation would most-likely not recover during the remaining summer recreation season.

- UPPCO has never operated during the test period with an start of month target elevation of 1340.0 feet NGVD.

3. March and April start of month targets and minimums

- If there is not enough room in the DRSB to capture spring runoff, the reservoir elevation will rise rapidly until the spillway elevation is reached because maximum releases are limited until the elevation reaches the spillway.
- The nominal minimum spillway elevation is at an elevation of 1344.6 feet NGVD or approximately 3.5 feet above the start of month target elevations for the summer recreation season.
- UPPCO must take all reasonable steps to lower the impoundment to the target elevation.
- Some shoreline owners have filed concerns with FERC about reservoir elevations exceeding 1341.0 feet NGVD.
- Lowering the reservoir elevation from 1344.6 feet NGVD to 1341.0 feet NGVD can take weeks.
- Through consultation with stakeholders, in 2014, the March and April start of month target and minimum reservoir elevations of 1337.5 feet NGVD and 1337.0 feet NGVD were eliminated and the reservoir was drawn down to an elevation of 1335.8 feet NGVD before spring runoff. Before the summer recreation season, the reservoir rose to an elevation of 1344.7 feet NGVD.
- Through consultation with stakeholders, in 2015, the March and April start of month target and minimum reservoir elevations of 1337.5 feet NGVD and 1337.0 feet NGVD were eliminated and the reservoir was drawn down to an elevation of approximately 1334.0 feet NGVD before spring runoff. Before the summer recreation season, the reservoir rose to an elevation of 1342.5 feet NGVD.
- In 2016, the March and April start of month target and minimum reservoir elevations of 1337.5 feet NGVD and 1337.0 feet NGVD were not deviated from because the SLSB was refilling from a drawdown for repairs the previous construction season. The DRSB was drawn down to a minimum elevation of 1337.9 feet NGVD before spring runoff. Before the summer recreation season, the reservoir rose to an elevation of 1343.2 feet NGVD.
- Through consultation with stakeholders, in 2017, fearing very little snowpack, and believing spring runoff would not occur in 2017, the start of month target elevation

for April 1 was changed to 1339.0 feet NGVD. The reservoir rose to an elevation of approximately 1345.1 feet NGVD in early May.

- The start of month target elevations and the minimum elevation requirements for the DRSB for March and April of each year are driven by the need to meet the start of month target elevations for the summer recreation season.
- During late February and early March, the operation of the DRSB is already dictated only by the need to achieve the start of month target elevations during the summer recreation season and guided by snowpack information.
- UPPCO has committed to conduct a meeting with stakeholders in February or early March. This commitment also renders the March and April elevation requirements unnecessary.

McClure Basin:

1. Maximum reservoir elevation

- Exceeding the maximum reservoir elevation at the McClure Dam causes water to flow over the spillway.

ANOMALIES IN OPERATION

2013-2014 Test Period

Spring runoff in 2014 was higher than expected and occurred prior to UPPCO being able to fully draw down the DRSB as planned. UPPCO began drawing down the DRSB to an elevation of 1335.0 feet NGVD, but was only able to reach a minimum elevation of 1335.8 feet NGVD prior to the onset of spring runoff. This resulted in a maximum spring reservoir elevation at the DRSB of 1344.7 feet NGVD. The DRSB remained above 1341.0 feet NGVD until June 19, 2014.

Under the Consent Judgment for the Dead River Recovery Effort with the Michigan Department of Environmental Quality, UPPCO released approximately 150 cfs from the low-level outlet at the SLSB for approximately 72 hours (May 2 to May 5, 2014), resulting in a maximum elevation of approximately 1484.5 feet NGVD on the last day of May. This activity had some, but minimal impact upon the ability of UPPCO to achieve a start of month target elevation of 1485.04 feet NGVD for the month of June at the SLSB.

During the months of July and August, 2014, the Hoist powerhouse was out of service and unable to complete planned maintenance work on the turbine leads and thrust bearings. During the period the units were out of service, flows were passed through the low-level outlet at the Hoist Dam. Approximately 100 to 105 cfs was passed during this time frame. The theoretical maximum capacity of the low-level outlet at a DRSB elevation of 1341.0 feet NGVD is approximately 125 cfs. During this time-period, the DRSB elevation was at or near 1341.0 feet NGVD.

2014-2015 Test Period

During the Spring of 2015 UPPCO initiated a planned deviation and planned drawdown of the SLSB to reach an elevation of 1476.0 feet NGVD to complete work on the dam. Drawdown of the SLSB took place just after the peak-runoff period until the anticipated construction start date of July 15, 2015. The SLSB would not refill again until May 10, 2017.

UPPCO also initiated a planned deviation prior to the planned drawdown to reduce the intensity of flows needed to draw SLSB down in the necessary timeframe necessary to meet construction deadlines. The planned deviation suggested lowering the June start of month target elevation for the SLSB from 1480.5 feet NGVD to 1479.0 feet NGVD, and lowering

the June monthly minimum elevation at SLSB from 1480.5 feet NGVD to 1479.0 feet NGVD. UPPCO also suggested keeping the June start of month target elevation for the DRSB at 1342.0 feet NGVD, to allow for increased storage capacity during the upcoming summer months.

Due to an unexpected amount of heavy precipitation during the spring and early summer months, UPPCO was unable to fully reach the target elevation of 1479.0 feet NGVD at the SLSB as proposed in the planned deviation. UPPCO still initiated the drawdown of SLSB, and maintained compliance with the summer recreation elevation of 1341.0 feet NGVD by using the proposed 1342.0 feet NGVD at DRSB as a storage buffer. The maximum elevation reached in the DRSB for 2015 was 1342.9 feet NGVD on or about May 31, 2015.

2015-2016 Test Period

As stated previously, during the spring of 2015 UPPCO initiated a planned deviation and a planned drawdown of its SLSB to reach an elevation of 1476.0 feet NGVD. Drawdown of SLSB took place just after the peak-runoff period and occurred until the construction start date, July 15, 2015.

The data shows the effects of this drawdown in terms of both flows and elevations at SLSB for the remainder of 2015 and throughout 2016. In addition to limited reservoir elevations resulting from the drawdown, UPPCO was unable to release any flows above the required minimum monthly flows while it strived to refill the SLSB to 1485.04 feet NGVD per FERC Dam Safety requirements. Refill did not occur during the 2015-2016 Test Period.

Additionally, UPPCO had a period in 2015 where it entered dry year consultation with Stakeholders to attempt to meet license requirements. From late September to late December of 2015, UPPCO released reduced minimum flows. UPPCO returned the DRSB and the MB to normal operations on December 28, 2015 when the DRSB elevation was 1338.9 feet NGVD (December minimum elevation is 1338.5 feet NGVD and January start of month target is 1339.0 feet NGVD).

On March 22, 2016, UPPCO conducted a planned deviation at the DRSB, to avoid a potential inability to recover from the April start of month target elevation (1337.5 feet NGVD) and to maintain higher elevations at DRSB for the recreation season. UPPCO targeted elevation

1342.0 feet NGVD with proposed storage to 1343.0 feet NGVD. UPPCO continued this planned deviation until Labor Day. The maximum elevation reached at the DRSB during the planned deviation period in 2016 was approximately 1343.2 feet NGVD on April 29th.

The planned deviations resulting from the FERC Dam Safety Restrictions at the SLSB resulted in extending the three-year test period to the 2016-2017 season.

2016-2017 Test Period

On August 1, 2016, UPPCO conducted a planned deviation to curtail the required minimum flow release of 80 cfs from the MB for penstock inspection and concrete work and allow the MB elevation to exceed 1196.4 feet NGVD to pass water over the spillway and downstream. During that time-period, the maximum reservoir elevation for the MB was approximately 1196.6 feet NGVD on August 15, 2016. Normal operation resumed on August 16, 2016.

With the FERC Dam Safety restrictions at the SLSB, planned deviations were implemented during early 2017 to assure the DRSB could maintain its target elevation of 1341.0 feet NGVD during the summer recreation season. The following planned deviations were implemented:

- On March 6, 2017, at a DRSB elevation of approximately 1338.5 feet NGVD, UPPCO conducted a planned deviation to change the start of month target elevation for April from 1337.5 feet NGVD to 1338.5 feet NGVD. This was to preserve the water being stored, knowing the SLSB might not be available to provide additional storage for the DRSB during the summer recreation season.
- On Monday March 17, 2017, UPPCO modified the April start of month target elevation deviation from 1338.5 feet NGVD to 1339.0 feet NGVD. Normal operation of the DRSB resumed when the elevation rose above 1341.0 feet NGVD during early April. The maximum reservoir elevation for the DRSB of 1345.1 feet NGVD occurred in early May.

On May 10, 2017, the FERC Dam Safety restrictions were lifted for the SLSB and the it resumed normal operation.

RECOMMENDATIONS TO MODIFY PROJECT OPERATIONS TO ACHIEVE COMPLIANCE

Silver Lake Storage Basin:

In the simplest terms, the recommended changes below allow for UPPCO to fill the SLSB during spring runoff. Hold the water in the SLSB until it needs to be released to the DRSB to maintain the start of month target elevations and support water quality during the summer recreation season. The changes will allow for the intended operation of the Dead River Hydroelectric Project without restrictions that cannot adapt to the changing factors leading to spring runoff each year.

1. Modify the start of month targets as follows:
    a. May-1485.02 feet NGVD
    b. June-1485.02 feet NGVD
    c. July 1485.02 feet NGVD
    d. August 1483.2 feet NGVD
    e. September 1481.4 feet NGVD
2. Maintain target elevations for the remaining months as currently listed under Article 402 of the license.
3. During all months of the year, operate the SLSB above the monthly minimum reservoir elevations.
4. If SLSB elevations or target elevations cannot be maintained due to minimum flow requirements less than inflow, continue to release minimum flows.
5. At all times maintain the monthly minimum flows as required from the SLSB.

Dead River Storage Basin:

1. Schedule a meeting and invite stakeholders (MDNR, MDEQ, USFWS and DRCI) in February or early March to provide information on current elevations of both the SLSB and the DRSB. During the consultation, UPPCO will also provide snowpack and water equivalency information to try to predict the amount of spring runoff. UPPCO will also outline their plan for reservoir elevation management at the DRSB prior to spring runoff to accommodate the anticipated Spring runoff event.
2. Change the May start of month target elevation for the DRSB to 1341.0 feet NGVD.

McClure Basin:

1. No changes are recommended.

PROPOSED AMENDMENTS TO LICENSE CONDITIONS

The proposed amendments are outlined by facility or development in the recommendations to modify project operations to achieve compliance section above.

RECOMMENDATIONS FOR INCREASED MONITORING

UPPCO does not suggest any increased monitoring. UPPCO believes that current License monitoring requirements are sufficient to maintain compliance, therefore, no additional monitoring or reporting is being suggested in this report.

ATTACHMENT A- HOURLY HEADWATER ELEVATION DATA

ATTACHMENT B- HOURLY TOTAL PLANT FLOW DATA