UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Séliš Ksanka Qĺispé Project	)	Project No. 5-000

ENERGY KEEPERS, INCORPORATED'S AND THE CONFEDERATED SALISH AND KOOTENAI TRIBES OF THE FLATHEAD RESERVATION'S RESPONSE TO NATIONAL ORGANIZATION TO SAVE FLATHEAD LAKE'S (NOSFL) JANUARY 4 AND 5, 2024 REQUEST AND PETITION

Sxʷnq̓ ʔels l Suw̓ ečm / Ksukłiłmumał ʾA ·kʾ ałmukwaʾits, Incorporated (d/b/a Energy Keepers, Incorporated) ("EKI") and the Confederated Salish and Kootenai Tribes of the Flathead Reservation ("CSKT") (collectively, the "Licensees"), Licensees for the Séliš Ksanka Qĺispé Project No. 5 (the "SKQ Project" or "Project"), hereby submit to the Federal Energy Regulatory Commission ("FERC" or the "Commission") this response to the January 5, 2024 petition of the National Organization to Save Flathead Lake ("NOSFL") and NOSFL's related request submitted to the Commission on January 4, 2024 (together, the "NOSFL Petition").[1]

NOSFL requests that the Commission require the Licensees to implement an unapproved, modified version of a draft drought management plan prepared by a prior licensee of the SKQ Project, PPL Montana, LLC and submitted it to the Secretary of the Interior in 2002 (the "2002 DMP"), which would involve reducing drawdown in the spring for flood control and reducing minimum instream flow releases from May 16 to June 30, 2024, and potentially into July. NOSFL makes this request with the myopic and self-serving goal of ensuring that the Flathead Lake level will be at elevation 2,892.2 feet mean sea level ("msl") from June 15 to September

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1 National Organization to Save Flathead Lake (NOSFL) Petition for Operational Revisions to Remediate Dangerously Low Water Levels at Flathead Lake, Project No. 5-000 (filed Jan. 5, 2024); Letter from Carole James, NOSFL President, to Kimberly Bose, FERC Secretary, Project No. 5-000 (filed Jan. 4, 2024).

15. The relief that NOSFL requests is unwarranted and would require the Licensees to unnecessarily depart from the license conditions—including mandatory conditions added to the license for protection of CSKT's reservation and related fish and wildlife resources—to serve the interests of a single, small group. The Licensees request that the Commission take no action on NOSFL's submissions for the reasons set forth herein.[2]

I. BACKGROUND

A. Licensees

The Flathead Indian Reservation, located in the mountains and valleys of Northwest Montana in the upper Columbia River Basin, is home to CSKT. CSKT includes the Salish, the Pend d'Oreille, and the Kootenai Tribes. CSKT preserved the Flathead Indian Reservation as a permanent homeland for Tribal people by the terms of the Hellgate Treaty of 1855.[3] Although decades ago the Reservation was open to non-Indian settlement, CSKT now owns over 70% of Reservation lands including the bed and banks of the southern half of Flathead Lake. The CSKT are nationally recognized as a leader amongst Tribal nations for exercising their sovereign powers to preserve and protect the cultural, wildlife, and natural resources of their traditional homeland now and for future generations.

EKI is a federally chartered corporation created and wholly owned by CSKT, pursuant to section 17 of the Indian Reorganization Act of 1934.[4] CSKT and EKI are the co-licensees of the SKQ Project.[5] The SKQ Project is located on the Flathead Indian Reservation four and a half

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[2] Alternatively, Licensees request that the petition be denied by the Commission. Procedurally, NOFSL never served the January 4, 2024 filing on Licensees as required by Commission regulations.

[3] 12 Stat. 975, ratified Mar 8, 1859, proclaimed Apr. 18, 1859.

[4] 25 U.S.C. § 477.

[5] *See Confederated Salish & Kootenai Tribes*, 152 FERC ¶ 62,140, *reh'g denied*, 153 FERC ¶ 61,217 (2015). The SKQ Project is formerly known as the Kerr Project. The Project name was changed on November 9, 2015. *Confederated Salish & Kootenai Tribes of the Flathead Rsrv.*, 153 FERC ¶ 62,092 (2015).

miles downstream of the natural outlet of Flathead Lake on the Lower Flathead River. CSKT, with their wholly owned section 17 Corporation, EKI, are the only federally recognized Indian tribes that solely own a FERC licensed project.

The Project was originally licensed in 1930 to Rocky Mountain Power Company. In 1939, Rocky Mountain Power Company transferred its interest in the license to their parent company the Montana Power Company. In 1976, CSKT filed a competing application with FERC for relicensure of the Project to protect the cultural, wildlife, and natural resources of their traditional homeland. In a 1985 settlement of the relicensing proceeding, CSKT negotiated co-licensee status with Montana Power Company and the option to acquire the Project as the sole owner in 2015. The Commission's 1985 Order Approving Settlement and Issuing License provided that Montana Power Company would own and operate the project for the first 30 years of the 50-year license term, after which CSKT would become the owner and sole licensee of the project upon exercising their option to purchase the project.[6] Before CSKT became the sole licensee, Montana Power Company transferred the license to PPL Montana, LLC,[7] who subsequently partially transferred the license to NorthWestern Energy.[8] In 2015, CSKT exercised its exclusive and unilateral right to acquire the Project through EKI.[9] Since that time, CSKT and EKI have operated the Project consistent with the terms of the license to protect cultural, wildlife, and natural resources.

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6 *Mont. Power Co.*, 32 FERC ¶ 61,070, *as amended*, 32 FERC ¶ 61,460 (1985).

7 *Mont. Power Co.*, 88 FERC ¶ 62,010 (1999).

8 *PPL Mont., LLC*, 148 FERC ¶ 62,072 (2014).

9 *Confederated Salish & Kootenai Tribes*, 152 FERC ¶ 62,140.

B. License Conditions Implicated by the NOSFL Petition

The Project license balances the competing considerations of stream flows, flood control, shoreline erosion, and lake levels in the interest of preserving the various beneficial public uses of Flathead Lake. License conditions relevant to each of these considerations are implicated by NOSFL's proposal.

Article 43 of the license authorizes the Licensee to store 1,219,000 acre-feet ("1.219 million acre feet" or "MAF") for use by the licensee conditioned by flood control limitations imposed by the U.S. Army the Corps of Engineers ("USACE") on the timing of the execution of this authorization.[10] Article 43 provides that the Licensee may regulate Flathead Lake within a 10-foot range between elevations 2,883 and 2,893 feet mean sea level ("msl") in such a manner as will make not less than 1.219 MAF of storage capacity available to the Licensee.[11] Thus, the SKQ Project controls the top 10 feet of Flathead Lake within its natural geologic confines, storing 1.219 MAF of water for the purposes of hydroelectric generation. Article 43 is silent as to what, if any, water level must be met or maintained at any given time of the year. Article 43 conditions the authorization to fill Flatehead Lake on flood control limitations in accordance with the Memorandum of Understanding ("MOU") between Montana Power Company and USACE dated May 31, 1962, as amended on October 15, 1965.

The MOU was created to "establish procedures and principles for the regulation of Flathead Lake in the interests of flood control downstream thereof."[12] As originally drafted, the MOU required water to be withdrawn from Flathead Lake to draw Flathead Lake down to

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[10] *Mont. Power Co.*, 32 FERC ¶ 61,070 at p. 61,185.

[11] *Id.*

[12] Memorandum of Understanding between Montana Power Company and USACE, at 1 (May 31, 1962) ("MOU").

elevation 2,883 feet on or about April 15 for flood control.[13] The MOU was later amended to add a provision, specifying how Flathead Lake would be refilled. In particular, the provision allowed for the level of the Flathead Lake to be raised to elevation 2,890 feet by Memorial Day and thereafter as early "as possible" to reach 2,893 feet.[14] The MOU does not provide static requirements. Rather the MOU provides procedures and principles that can be "modified by mutual consent to meet changed conditions."[15] The MOU's data exchanges and coordination procedures allow operations to adapt to changing conditions and facilitates decision-making in the exercise of the authority provided by Article 43 focused on flood control.

License Article 56 protects aquatic resources downstream of the SKQ Project by establishing minimum instream flows that must be met at specified times of the year, particularly during the summer months.[16] The flows established under Article 56 are minimums. Article 56 was imposed as a mandatory condition on the license under section 4(e) of the Federal Power Act ("FPA")[17] by the Department of the Interior ("Interior").[18] Article 56 prohibits deviation from the specified minimum flows unless necessitated by an operating emergency beyond the control of the Licensee or for short periods upon prior written approval from the Secretary of the Interior.

Article 60 requires the Licensees to develop and implement a drought management plan for Flathead Lake to facilitate compliance with Article 56 minimum instream flows, and to file

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13 *Id.* ¶ (a).

14 *Mont. Power Co.*, 35 FPC 250 (1966).

15 MOU ¶ (e).

16 *Mont. Power Co.*, 79 FERC ¶ 61,376 at p. 62,616 (1997), *order on reh'g*, 85 FERC ¶ 61,164 (1998),

17 16 U.S.C. § 797(e).

18 *See Mont. Power Co.*, 79 FERC ¶ 61,376.

the plan with the Secretary of the Interior.[19] Like Article 56, Article 60 was imposed under section 4(e) of the FPA by Interior.[20] The former owner of the SKQ Dam, PPL Montana, prepared the 2002 DMP and submitted it to the Secretary of the Interior. Interior, through the Bureau of Indian Affairs ("BIA"), prepared a Final Environmental Impact Statement ("FEIS") to evaluate the environmental impacts of the 2002 DMP. The FEIS evaluated the 2002 DMP, a no action alternative, and two action alternatives. However, the Secretary of the Interior has not issued a Record of Decision to adopt or finalize the 2002 DMP, and a final DMP was never filed with FERC.

Article 68 of the license requires actions to manage erosion on the north shore of Flathead Lake.[21] Specifically, the article requires the Licensee to "construct a shore aligned north shore erosion control project and associated habitat development features" consisting of revetments located on the Flathead Waterfowl Production Area and along the west riverbank of the Flathead River.[22] In 2023, EKI commissioned a study assessing the shoreline restoration on the north shore of Flathead Lake. The study's conclusions are significant. The Licensee's Flathead Lake management practices and the erosion control structures have stopped north shore erosion and created over 20 new acres of habitat. More importantly the study links the harm caused by erosion to Flathead Lake levels. Lower Flathead Lake levels reduce the erosion harm caused by the power of wave action. The study reads in relevant part as follows:

> 1) erosion control structures built between 2007 and completed in 2012 have successfully stopped shoreline erosion and will continue to for the life of SKQ dam, 2) over 20 new acres of aquatic and wetland habitat has been created and more will develop in the future, how much, depends on how the lake level is regulated, 3) the

19 *Id.* at p. 62,617.

20 *See Mont. Power Co.*, 85 FERC ¶ 61,164 (1998).

21 *Mont. Power Co.*, 82 FERC ¶ 61,101 at pp. 61,375-76 (1998).

22 *Id.* at p. 61,375.

> way Energy Keepers have regulated lake levels in Flathead Lake is slightly different than how past power companies have operated the dam. They begin a gradual drawdown at the end of June reaching a lake elevation of 2891' by November 1. The result has been a significant reduction in harm caused to the nearshore environment of Flathead Lake due to wave erosion coupled with regrowth of new wetland plants thereby transforming barren lakebed into new wetland habitat.
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> That reduction in harm caused by wave erosion is directly attributable to a reduction in the amount of wave power concentrated between lake levels of 2893 ft and 2891 ft (Somers Datum).[23]

The practices of prior licensees to maintain high elevations of Flathead Lake harmed the north shore. During the years 2000 through 2006 prior licensees concentrated "67% of the annual wave power between 2983 ft and 2891 ft. This is the period of maximum wave erosion."[24] In contrast, the Licensees have "reduced the amount of wave power concentrated above 2891 ft to 21.5% between 2017 and 2023."[25] This was accomplished by starting Flathead Lake draw down after Labor Day from 2893 feet to 2891 feet by October 31 to limit the wave damage caused by fall storms.[26] This reduces the wave power concentered above 2891 feet from 67% to 31%[27] thereby producing the erosion control benefits demonstrated by the study.

II. THE COMMISSION SHOULD NOT ACT ON THE NOSFL PETITION.

NOSFL asserts that the Commission must require the Licensees to implement an <u>unapproved, outdated,</u> and <u>modified</u> version of the draft 2002 DMP.[28] In particular, NOSFL asserts that the Licensees should be required to implement Alternative 2 to the draft 2002 DMP evaluated in the BIA's FEIS. This would involve not only modifying flood control drawdown

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23 M. Lorang et al., *Assessing Shoreline Restoration on the North Shore of Flathead Lake* at 2 (Final Draft Report Dec. 11, 2023) (the "2023 Lorang Study") (attached hereto as Attachment A).

24 *Id*. at 2-3.

25 *Id*. at 3.

26 *Id*.

27 *Id*.

28 NOSFL Petition at 3, 17.

targets established by the MOU, but would also require the Licensees to deviate from the minimum instream flows established by Article 56. Licensees recognize their obligation is to satisfy the instream flow requirements of Article 56.

As further explained below, the Commission should not act on NOSFL's request for four primary reasons: (1) the Licensees are complying with all of the license requirements, and thus deviation from the license requirements is neither necessary, nor appropriate; (2) NOSFL's request is inconsistent with the license requirement that minimum instream flows must be maintained; (3) implementation of an outdated unapproved, draft drought management plan is not required and would be imprudent; and (4) NOSFL's request is inconsistent with the delicate balance FERC struck between competing interests when it issued the license.

A. The Licensees Are Complying with the License Requirements.

NOSFL suggests that the Licensees cannot comply with all relevant license conditions, and thus must be required to implement a plan to deviate from the license conditions.[29] This is incorrect. The Licensees can and are complying with the terms of the license, including Flathead Lake elevation authorizations and limitations, and minimum instream flow requirements.

As noted above, Article 43 of the license states that the Licensee is authorized to regulate Flathead Lake within a 10-foot range between elevations 2,883 and 2,893 feet msl. As the Chairman of the Commission recognized in his January 16, 2024 letter: "After a peak water level of approximately 2892 feet msl in June, the lowest recorded water level was approximately 2890 in late October,"[30] well above the minimum elevation allowed by Article 43. Thus, in 2023, the Licensees operated the project within the range of elevations permitted under Article 43.

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29 *Id.* at 15-16.

30 Letter from Willie L. Phillips, FERC Chairman, to Rep. Matthew M. Rosendale, Sr., at 2, Project No. 5-000 (issued Jan. 16, 2024).

NOSFL points to the USACE MOU as a basis for asserting that the Flathead Lake level must be raised to elevation 2,890 feet by Memorial Day and thereafter as early "as possible" to reach 2,893 feet.[31] However, its reliance on that provision as establishing Flathead Lake elevations as mandatory minimums is misguided. The MOU is for flood control and establishes these two particular elevations as maximums not to be exceeded without concurrence from USACE, as was the case in the Licensees' operations in 2023. The MOU contemplates that procedures and principles under the MOU could be "modified by mutual consent to meet changed conditions." As the only two parties to the MOU, USACE and the Licensees mutually consented to modify Flathead Lake level targets in 2023 due to the low flow conditions.[32] This is an illustration of the Licensees proactive management with the USACE to adjust the maximum elevations in light of specific water supply conditions. USACE and the Licensees coordinate frequently through the spring freshet season every year to facilitate compliance with the MOU and minimum instream flow requirements.

In sum, the Licensees are complying with the license by operating the Project between elevations 2,883 and 2,893 feet msl. Furthermore, the Licensees met the minimum instream flow requirements under Article 56 in 2023[33] and anticipate that they will be able to do so again in 2024. Pursuant to Article 62 of the License, the Licensees have kept the Commission and Interior apprised of the Project's operating schedule by submitting annual plans, supplemented

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[31] NOSFL Petition at 5.

[32] U.S. Army Corps of Engineers, Declaration of Initiation of System Refill, Flood Risk Management Requirements Report #5 for Water Year 2023 (Apr. 27, 2020), *available at* https://pweb.crohms.org/report/flood_risk/20230427.pdf; U.S. Army Corps of Engineers, Flood Risk Management Requirements, Report #10 for Water Year 2023 (May 24, 2023), *available at* https://pweb.crohms.org/report/flood_risk/20230524.pdf.

[33] NOSFL complains that the Licensees released more than the minimum instream flow in 2023. Doing so was entirely consistent with Article 56, which prescribes minimum (not maximum) instream flow requirements.

by monthly updates, with projected and actual operational, Flathead Lake elevation, and discharge information.[34]

B. NOSFL's Request Is Inconsistent with, and Unsupported by, the License.

NOSFL's request advocates that minimum Flathead Lake levels not contained in the license be maintained at the expense of license mandated minimum instream flows. This is plainly inconsistent with the license. Article 56, a mandatory condition under FPA section 4(e), requires the Licensees to release specified minimum flows to protect the lower Flathead River, its aquatic resources, and utilization of the Reservation. It may not be modified without Interior's consent.

The license does not contemplate that minimum instream flows would be relaxed for purposes of maintaining Flathead Lake levels, regardless of drought conditions. Although Article 60 requires the Licensee to develop a drought management plan and file it with the Secretary of the Interior,[35] it does not allow for relaxation of minimum instream flow requirements in the event of a drought. Instead, Article 60 provides:

> The drought management plan shall include, but not be limited to, provision for re-evaluation and adjustment of Flathead Lake flood control requirements and other provisions necessary <u>to facilitate compliance with lower Flathead River minimum instream flow requirements</u> designated by the Secretary of the Interior.[36]

Thus, Article 60's language makes clear that the primary purpose of the drought management plan is to maintain instream flow into the lower Flathead River during drought. To do so, Article 60 contemplates that modifications would be made to *flood control* requirements, not that minimum instream flows be sacrificed to maintain non-license required Flathead Lake levels.

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[34] *Mont. Power Co.*, 79 FERC ¶ 61,376 at p. 62,617.

[35] FERC acknowledged that, until the project was conveyed to CSKT, the requirements of the license applied to PPL Montana. *See PPL Mont., LLC*, 98 FERC ¶ 61,098 at p. 61,308 (2002).

[36] *Mont. Power Co.*, 79 FERC ¶ 61,376 at p. 62,617 (emphasis added).

The history of the development of Article 60 also supports this understanding. Both Article 56 and Article 60 were imposed as mandatory FPA section 4(e) conditions by Interior. Commission staff was concerned that Article 60 made no provision for considering the impact on Flathead Lake of providing required minimum flows under drought conditions.[37] Thus, Commission staff recommended, and FERC adopted, new license Article 77, which provided that the drought management plan include criteria for determining when minimum discharge requirements could be relaxed to meet target Flathead Lake levels.[38] Interior objected to Article 77, contending that it would favor Flathead Lake levels at the expense of minimum instream flows, revealing "a predisposition to sacrifice tribal trust resources."[39] According to Interior, the proposal would have "undermine[d] a section 4(e) condition deemed necessary for the adequate protection and utilization of the reservation and is not permissible."[40] In Interior's view, "the drought management plan would provide for a reevaluation and adjustment of flood control requirements . . . and coordination of other interests on the Flathead River system."[41] In response, Interior amended Article 60 to include a requirement that the drought management plan be filed with Interior and to reserve Interior's authority to reject or modify the plan.[42] Acknowledging that it was required to accept Interior's mandatory conditions, FERC issued the license order with Interior's clarified condition and deleted Article 77 from the license.[43]

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[37] *See Mont. Power Co.*, 85 FERC ¶ 61,164 at pp. 61,656-57.

[38] *Id.* at p. 61,656.

[39] *Id.*

[40] *See* U.S. Department of the Interior Comments on FERC's Final EIS at 12, Project No. 5-051 (filed Aug. 16, 1996).

[41] *Id.*

[42] *Mont. Power Co.*, 85 FERC ¶ 61,164 at pp. 61,656-57.

[43] *Id*. at p. 61,658.

In sum, Article 60 and the history of its adoption demonstrate that the purpose of Article 60 and the drought management plan to be developed thereunder was to maintain minimum instream flows, even in the face of drought conditions, not to relax minimum instream flow conditions for purposes of maintaining a particular Flathead Lake level.[44]

C. The Licensees Are Not Bound by the 2002 DMP and Should Not Be Required to Follow It.

NOSFL incorrectly contends that the Licensees should be required to violate minimum instream flow requirements to maintain Flathead Lake levels not called for in the license pursuant to an unapproved alternative to an unapproved draft drought management plan developed by the prior licensee, specifically Alternative 2 in the BIA's FEIS.

Pursuant to Article 60, PPL Montana submitted the 2002 DMP to the Secretary of the Interior on March 4, 2002.[45] In March 2010 Interior, acting through BIA, prepared an FEIS analyzing the environmental impacts of PPL Montana's draft plan as well as a no action alternative and two action alternatives.[46] Although the FEIS identified Alternative 2 as the BIA's "preferred alternative," the FEIS expressly stated that

> "The final decision will be made in a separate document – called a Record of Decision (ROD). The ROD will identify the specific actions and procedures that must be included in the final Drought Management Plan and will state specifically the next steps required by PPL, Montana and the CSKT in finalizing the plan."[47]

To date, the Secretary of the Interior has not issued a record of decision formally approving the draft 2002 DMP or any other procedures that the Licensees must implement during drought

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[44] Although Interior considered alternatives to the draft 2002 DMP that would allow for modification to instream flows, neither the 2002 DMP nor the alternatives considered in the FEIS were ever approved.

[45] *See* Notice of Availability of a Draft Environmental Impact Statement for a Drought Management Plan for Operation of the Kerr Hydroelectric Project, Flathead Lake, MT, 71 Fed. Reg. 42,414 (July 26, 2006).

[46] Bureau of Indian Affairs, Environmental Impact Statement, Drought Management Planning at the Kerr Hydroelectric Project (FERC Project No. 5) (Mar. 2010).

[47] *Id.* at S-16.

conditions. Consequently, no drought management plan has ever been legally binding on the Licensees.

Although NOSFL contends that the prior licensees' conduct was consistent with the draft 2002 DMP, their conduct does not bind the Licensees.[48] Until Interior formally approves a drought management plan, the Licensees' drought management practices are bound only by the provisions of the License. As explained above, even in drought conditions, EKI has complied with the terms of the license and has an operational plan for 2024 that will allow it to do so again this year in the face of continuing drought conditions.

Furthermore, contrary to NOSFL's assertion that "PPL's and Northwestern's past practice during drought conditions establish a standard of prudent management against which [EKI's] operations should be measured,"[49] the past practices of the prior licensees were imprudent and did not appropriately balance the competing considerations under the license. Prior to the license amendment that included Article 60, climatic and economic conditions prevalent under prior ownership of the SKQ Project pitted power production goals and economic value against operating conditions necessary to protect ecologic resources under the jurisdiction of Secretary of the Interior.[50] Specifically, minimum instream flows below the facility necessary to protect fish were at risk and in fact sacrificed when those previous licensees did not conserve enough of the 1.219 MAF of storage in a given year to allow for achieving the full amount of storage the subsequent drought year. In addition, preserving the 1.219 MAF of water for utilization in the winter months under the goals of previous owners caused excessive erosion impacts around the

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48 NOSFL Petition at 10-12.

49 *Id.* at 12.

50 *Id.* at 2, 10 n.24. (The PPL Montana 2001 request cited by NOSFL as desired licensee behavior is illustrative of behavior that is harmful to the ecologic resources that license article, and the Secretary of the Interior's actions were intended to prevent.)

shoreline of the Flathead Lake and loss of riparian habitat. In 1997, the Commission amended the license to include two additional mandatory FPA section 4(e) conditions imposed by the Secretary of the Interior—specifically Articles 68 and 60—to protect these resources.[51] Nevertheless, PPL Montana filed their draft 2002 DMP with the Secretary of the Interior seeking blanket authorization by the Secretary to sacrifice CSKT resources to maintain their goal of holding artificially high Flathead Lake levels into the winter months.

It would also be imprudent for the Licensees to implement the draft 2002 DMP (or one of the alternatives considered in the FEIS) because science and our understanding of climate change has evolved significantly since the draft was proposed and the FEIS was issued. The triggers for implementation of a drought plan under the FEIS illustrate this point. The triggers are volume based on the water supply forecast for the April through September time period and do not capture rapid snow melt or deteriorating forecasts which led to the low Flathead Lake level in 2023. Forecasted climate change, if realized, will drive the shape of the runoff in the Flathead Basin further from these triggers because spring runoff in Montana is projected to increase as a result of warmer temperatures and earlier snowmelt. Increased January-April runoff will lead to increasingly low streamflow in July-September.[52] In addition, the FEIS is based on the premise that drought conditions are expected to occur only about one time every 18 years, based on the water history in the basin at the time the FEIS was issued.[53] In fact, as NOSFL acknowledges, expectations regarding the frequency and intensity of drought conditions have changed since

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[51] *See Mont. Power Co.*, 79 FERC ¶ 61,376.

[52] NOSFL Petition at 45-46.

[53] FEIS at S-1.

2002.[54] In sum, contrary to NOSFL's assertions, it would be imprudent for the Licensees to be required to operate under an outdated draft management plan.

The Licensees are proactively coordinating with USACE on an ongoing basis consistent with best practices and their license obligations. The Licensees recognize they have not yet formally documented their practices and intend to do so. The Licensees' documentation will reflect current science, environmental conditions, water management tools, and correctly balance the competing interests affecting the Licensees' operation of Flathead Lake to protect the instream flows required by the SKQ Project license. Once the documentation is completed with appropriate consultations it will be submitted to the Secretary of the Interior and filed with the Commission.

D. NOSFL's Request Is Not in the Public Interest.

Under the FPA, FERC is required to

> "[G]ive equal consideration to the [power and development purposes for which licenses are issued,] purposes of energy conservation, the protection, mitigation of damage to, and enhancement of, fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality."[55]

In issuing the license, FERC did just that. In the severe drought year of 2023, the Licensees were able to meet all the license conditions.

NOSFL conveniently ignores that Licensees must balance competing priorities in regulating Flathead Lake, including instream flows, shore erosion, flood control, recreation, and power generation. Instead, NOSFL fixates on a small subset of the Flathead Lake's recreational

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[54] The NOSFL Petition argues that drought conditions existed in 2023 and are also anticipated in 2024.

[55] 16 U.S.C. § 797(e).

uses that is narrowly circumscribed to a limited portion of the lake's shoreline, at the expense of the other considerations.

First, NOSFL's proposal would undermine the Project's ongoing efforts to protect and maintain fish and wildlife, and particularly species listed and protected under the Endangered Species Act by reducing minimum instream flows. As explained above, relaxation of instream flow requirements is not contemplated by the license, even under drought conditions.[56] The numerous provisions included in the License for the protection of fish and wildlife demonstrate the primacy of concerns about impacts to those species. For example, Articles 45, 46, and 47 of the license require Licensees to conduct fish and wildlife studies, and to propose specific remedial measures to reduce the operational impacts of the Project on Flathead Lake and the lower Flathead River. Specifically, these articles require licensees to develop mitigation and management plans related to operational impacts on fish resources (Article 45), wildlife resources (Article 46), and habitat losses along the north shoreline of Flathead Lake (Article 47).

Second, NOSFL's request would undermine the Licensees' efforts to reduce North Shore erosion, as required under the license. As discussed above, Article 68 of the license requires the Licensees to "construct a shore aligned north shore erosion control project and associated habitat development features" consisting of revetments located on the Flathead Waterfowl Production Area and along the west riverbank of the Flathead River. The 2023 Lorang Study found that Licensees' regulation of lake levels has created over twenty new acres of aquatic and wetland habitat, with more to develop in the future. According to the study, the decisions made by the Licensees regarding lake levels have transformed barren lakebed into new wetland habitat by stimulating the regrowth of new wetland plants and significantly reducing the harm caused to the

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[56] *Mont. Power Co.*, 85 FERC ¶ 61,164 at p. 61,658 (Article 60).

nearshore environment of Flathead Lake by wave erosion.[57] The higher lake levels that NOSFL demands work at cross-purposes with avoidance of North Shore erosion and erosion generally. The 2023 Lorang Study documents the significant benefits of Licensees lake management practices in contrast to the practices of prior licensees. Therefore, what NOSFL asks FERC to implement would have the effect of undermining the North Shore erosion control efforts and general erosion control efforts. Licensees are implementing best practices.

Finally, NOSFL's request would serve only a limited subset of recreational interests. NOSFL is comprised of owners of second homes and other property with private docks along Flathead Lake. As droughts are projected to become more frequent and intense, and as the need for adaptive measures—including potential dock modifications—becomes apparent, NOSFL members seek relief from the possibility that they may have to take such adaptive measures to accommodate climate-induced lake level fluctuations.

NOSFL's members hardly represent the broad spectrum of lake users' recreational interests. Flathead Lake serves as a venue for myriad public and private recreation activities, both in the lake and ashore. Recreational opportunities include boating, fishing, hunting, trapping, camping, picnicking, and sightseeing, and, in the winter, ice-fishing, cross country skiing, ice skating, and snowmobiling.[58] All of these recreational interests are served regardless of whether the lake is maintained at the level requested by NOSFL. Indeed, drawing down the lake benefits some recreational uses by providing beach areas that can be used for swimming access, camping, and picnicking. Boating is also maintained at lower lake levels. As the BIA

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[57] 2023 Lorang Study at 2.

[58] Final Environmental Impact Statement for Proposed Modifications for the Kerr Hydroelectric Project at 3-42, Project No. 5-021 (issued July 2, 1996).

FEIS on the 2002 DMP points out, docks constructed on portions of the lake with deeper water would not be affected by drought to the same degree as those constructed in shallower areas.

In sum, NOSFL's request to prioritize lake levels over other interests is not in the public interest.

III. CONCLUSION

The Licensees request that the Commission take no action on the NOSFL Petition.[59] The alternative to the draft 2002 DMP that NOSFL asks the Commission to invoke was never accepted or finalized, is outdated, and would be harmful to the fisheries resources that are protected and prioritized under the License. The Licensees are proactively coordinating and sharing data with the USACE on an ongoing basis to facilitate decision-making consistent with best practices and license obligations. Once the documentation is completed with appropriate consultations it will be submitted to the Secretary of the Interior and filed with the Commission.

Respectfully submitted,

/s/ *Malcolm McLellan*

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Dated: February 5, 2024

59 Alternatively, Licensees request that the NOSFL Petition be denied by the Commission.

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Séliš Ksanka Qĺispé Project) Project No. 5-000

BRIAN LIPSCOMB VERIFICATION

1. I, Brian Lipscomb, am the Chief Executive Officer of Energy Keepers, Incorporated ("EKI").

2. I have personal knowledge of the factual statements asserted by EKI and the Confederated Salish and Kootenai Tribes of the Flathead Reservation in Energy Keepers, Incorporated's and the Confederated Salish and Kootenai Tribes of the Flathead Reservation's Response to National Organization to Save Flathead Lake's (NOSFL) January 4 and 5, 2024 Request and Petition.

3. I verify that the factual statements are true and correct.

/s/ *Brian Lipscomb*
Brian Lipscomb
Chief Executive Officer
Energy Keepers, Incorporated

Dated: February 5, 2024

Attachment A

Study Report

M. Lorang et al., *Assessing Shoreline Restoration on the North Shore of Flathead Lake* (Final Draft Report December 11, 2023)

Assessing Shoreline Restoration on the North Shore of Flathead Lake

By: Dr. Mark Lorang, Freshwater Map, President, Chief Science Officer

for

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Objectives

Freshwater Map, in its capacity as monitoring consultant to Energy Keepers, Incorporated, (EKI) has addressed the following 3 objectives.

1. Measure the 2023 condition of the north shore erosion control beaches and other erosion control structures along the riverbanks using drone imagery and repeated foot-survey photographs of the shoreline.
2. Compare the change between 2017 and 2023.
3. Link changes in shoreline position, condition, and aquatic habitat to lake level regulation and wind-wave events since 2017.

General Overview

Drone imagery and repeated foot-survey photographs of the shoreline were used to assess the 2023 condition of the North Shore erosion control beaches that were built to stop wave erosion to the USFWS lands comprising the Waterfowl Production Area (WPA). Drone based Lidar data of the north shore was collected in 2017 and used as a baseline for comparison of change between 2017 and 2023. Drone-based aerial imagery collected in 2016 and 2017 including foot-survey photographs completed in those years (see 2016, 2017 EKI reports for those details) was also used to assess change.

The Energy Keepers Inc., use Seli'š Ksanka Qlispe' (*SKQ*) Dam to regulate lake level in Flathead Lake. Linking lake level regulation to the wave climate required using wind speed and direction data gathered by the University of Montana, Flathead Lake Biological Station's weather station located at the mouth of the Flathead River. That data was used to hindcast wave heights and periods following standard practice established by the US Army Corps of Engineers and link that with lake level data collected by the USGS at their Polson gauge (monitoring station 1231550). That data was then compared with the measured changes in shoreline position and condition, including changes in aquatic and wetland habitat.

Three main conclusions supported by analysis of this date are, 1) erosion control structures built between 2007 and completed in 2012 have successfully stopped shoreline erosion and will continue to for the life of *SKQ* dam, 2) over 20 new acres of aquatic and wetland habitat has been created and more will develop in the future, how much, depends on how the lake level is regulated, 3) the way Energy Keepers have regulated lake levels in Flathead Lake is slightly different than how past power companies have operated the dam. They begin a gradual drawdown at the end of June reaching a lake elevation of 2891' by November 1. The result has been a significant reduction in harm caused to the nearshore environment of Flathead Lake due to wave erosion coupled with regrowth of new wetland plants thereby transforming barren lakebed into new wetland habitat.

That reduction in harm caused by wave erosion is directly attributable to a reduction in the amount of wave power concentrated between lake levels of 2893 ft and 2891 ft (Somers Datum). During the years 2000 and 2006 dam operations concentrated 67 % of the annual wave power between 2893 ft and 2891 ft. This is the period of maximum wave erosion. During this period shoreline erosion caused by lake level regulation was not factored into dam operation. The erosion mitigation period between 2007 and 2013 is defined by starting lake draw down after Labor Day from 2893' to 2891' by October 31 as the preferred operation to limit the impacts from fall storms. The result was that the percentage of wave power concentrated above 2891 ft was reduced from 67% to 31%.

In contrast the Energy Keepers have further reduced the amount of wave power concentrated above 2891 ft to 21.5% between 2017 and 2023. The results of this practice have greatly reduced the harm caused to the nearshore ecosystem of the lake while also reducing the harm to the lower river ecosystem. They have accomplished this outcome despite extreme variance in water delivery to Flathead Lake from wet to drought years.

The remainder of this report is organized in the following manner: a methods section followed by a primary results and conclusion section which is then followed by an supplementary results supporting the primary conclusions based on further linking lake level regulation with wind-wave events and measured beach response from Somers Beach State Park which borders the WPA. The final section is an assessment of change as reflected in photographs that compare shoreline condition in 2017 versus 2023. Discussion text is kept to a minimum throughout the remainder of the report, beyond the methods section, by using more detailed figure legends to fully explain the implications of each to the conclusions presented. There are 10 conclusions presented along with the primary data analysis that support each conclusion.

The format goal for this report is that each section and figure can be read and understood independently without reading text from a separate discussion section. Hence discussion not directly related to a conclusion or observation has been limited, making the report more manageable and useful. Any discussion is incorporated into the figure legend so that the reader can understand the context while looking at the data or photograph being presented.

Methods: *2023 Data Collection and Processing*

Aerial Imagery

RGB (Red, green, blue) drone imagery was collected on April 26th & 27th (low pool) and August 15th, 2023 (full pool). For the April flights we used an eBee Plus drone equipped with the SODA RGB sensor flown at approximately ~ 400 ft above ground surface. At this altitude, resolution of the imagery is ~1" per pixel. For the August flight we used the Wingtra drone with the Sony RX1R sensor flown at approximately ~ 400 ft above ground surface. At this altitude, resolution of the imagery is ~0.5" per pixel. The Wingtra drone was flown while using a Topcon Hiper SR GNSS Base Station to maximize horizontal and vertical accuracy of the GPS coordinates of each individual image. The GPS base station data was post-processed and then these coordinates were assigned to the individual photos. All imagery was post-processed in Pix4D software to create a singular image mosaic for a given date. The Wingra imagery acquired was used as the base imagery, the eBee imagery was rectified to the WIngtra imagery to correct for shifts and distortions in northings and eastings. The eBee image was rectified in ArcMap software. In addition to the RGB imagery, a Digital Surface Model (DSM) was generated in the Pix4D software. The eBee DSM was rectified using the same corrections as the RGB imagery.

DSMs are a 3-D representation of the heights of the earth's surface, including natural or man-made objects located on it. Unlike Digital Elevation Models (DEMs) derived from LiDAR that represent the earth's bare surface, algorithms that derive DSMs cannot "see" through vegetation to estimate the true "bare earth surface". Hence a DSM is like covering the earth's surface with a blanket and inherently has less accuracy than a LiDAR derived DEM. Furthermore, DSMs are derived from photogrammetry (rather than laser derived LiDAR), hence distortions from individual photos can also produce localized errors within the DSM.

DSM correction to Somers Datum (Lake Level)

Although, the rectification of the DSM and imagery correctly places it on the earth's surface in reference to northings and eastings, this does not correct distortions or errors in elevation values in the DSM. The DSM was corrected and adjusted to match Flathead Lake Level as recorded at USGS gauging station in Polson. This gauging station is based on the Somers Datum (SD). The datum is called the "Somers Datum" because the gauging station was previously located near Somers but was moved to the Polson location in 1998. Converting the Somers Datum elevations to mean sea level or other elevations referenced to different datums requires applying a correction factor.

To account for this elevation correction, we first used the base Wingtra DSM (highest accuracy in elevation) and identified the water surface line in image and then collected elevations values at intervals of 250 feet along this line. These elevations were then averaged to develop an elevation value for the water surface. The average elevation values were then compared to lake level registered at the USGS gauging station for the respective day to develop a correction factor to match the Somers Datum Lake level. This correction was also applied to eBee DSM.

Profile generation

Cross-sectional data from which profile plots were generated at key locations across the beaches that were established in 2017 with Lidar data baseline. Transects were drawn on the imagery/DSMs and the elevations were extracted and exported to excel for visualizations purposes. Errors in the DSM profiles were accounted for by aligning the DSM profiles to the Lidar-based profiles.

Collection of oblique photos

On April 26th-27th and August 15th -16th, 2023 we flew a DJI Phantom 4 drone at very low elevation (~ 30 feet above the ground surface) and at an oblique angle to capture shoreline conditions along the length of the constructed beaches. Individual photos were captured at ~30 feet intervals. Those photos are arranged in an ArcMap GIS format so that individual oblique photos can be matched to the location of interest.

Shoreline and Habitat Mapping

Shorelines were delineated from 2005 airborne imagery, 2016, and 2023 drone imagery to track changes in the position of the shoreline over time. All delineations were estimated from full pool imagery (except for the 2023 image, lake level was 2890.56’ for the August 15th, 2023, flight). For the 2005 and 2016 shoreline delineations, we used “heads-up” digitizing to manually estimate the position of the shoreline. We delineated the shoreline mapping the water line along the water/shoreline interface (which included mapping along exposed logs). Due to the lower water level in 2023 image, we estimated the 2023 shoreline by extracting 2893’ contour from 2023 DSM. The 2893 was visually inspected and manually edited if needed due to localized distortions in the DSM.

In addition, we mapped general habitat types (water, land, gravel) across the 3 years and calculated changes between the 3 years. Habitat delineations were manually generated by “head-up” digitizing. Habitat change was calculated for each time by overlaying the yearly habitat maps and calculating the areas of change or stability. We tracked and quantified changes in vegetation regrowth, erosion, and accretion, as well as areas that remained the same.

Wind-wave modeling and linkage to regulated water levels.

To assess the impact of lake level regulation on shoreline erosion due to waves it was necessary to estimate both wave power relative to measured lake levels and impacts to the beach. Lake level is recorded every 15 minutes at the USGS gauging station in Polson and the North Shore weather station located at the east side river mouth spit made it possible to hindcast wave estimates using wind data. Wave estimates were hindcast on 15-minute intervals to match with the reported lake levels. Those results were then bin-summed to determine how much wave power exists at each lake level.

Primary Results and Conclusions

Conclusions: 1 & 2

1) No measurable shoreline erosion has occurred on the North Shore between Nov 1, 2016, and Nov. 1, 2023. This conclusion is supported by comparison of data consisting of 2005 airborne imagery, 2016 drone imagery and Digital Surface Model (DSM), 2017 drone-base lidar and imagery with 2023 drone-imagery and DSM (Figs. 1-6). Both shore-attached, and offshore gravel beaches will continue to protect areas landward of them long into the future. Lake level draw down as the *EKI* have been regulating the lake will continue to greatly reduce potential wave erosion. Wave erosion to the USFWS Waterfowl Production Area (WPA) has been controlled and we now have a dynamically stable landscape that will outlast Seli’š Ksanka Qlispe’ (*SKQ*) Dam.

2) Over 20 acres of new wetland habitat has naturally been regenerated over the past decade since completion of the erosion control structures in 2012 (Fig. 5). New patches of aquatic plants as well as wetland-riparian patches that grade into an upland terrestrial habitat have naturally revegetated areas within the constructed spit embayment's and behind gravel banks. This process has transformed locations that were barren sand in 2005 into new valuable nearshore habitat. These changes are driven by dam operations, that control the water level and how that operation vertically distributes wave energy, and the way the erosion control beaches dissipate that energy.

Figure 1. This is a 2005 MT Department of Natural Resources airborne NAIP image of the north shore showing the USFWS Waterfowl Production (WPA) prior to the construction of erosion control structures that began in 2007 along what is now the MTFWP Osprey Landing property (see figure 4). The red line is the shoreline at that time and represents the limit of shoreline loss prior to construction of the both shore-attached, and offshore erosion control gravel beaches and gravel, large wood erosion control structures built to stop erosion to the WPA riverbanks. This line serves as a metric in the analysis of structure success in the 2016 and 2017 final reports to the *EKI* and are included in this final report. Success is defined then as maintaining this shoreline position. Construction of erosion control structures started in 2007 on the eastern edge of the WPA extending to the river mouth in 2009. Construction of erosion control structures was completed for both sides of the river mouth by 2012.

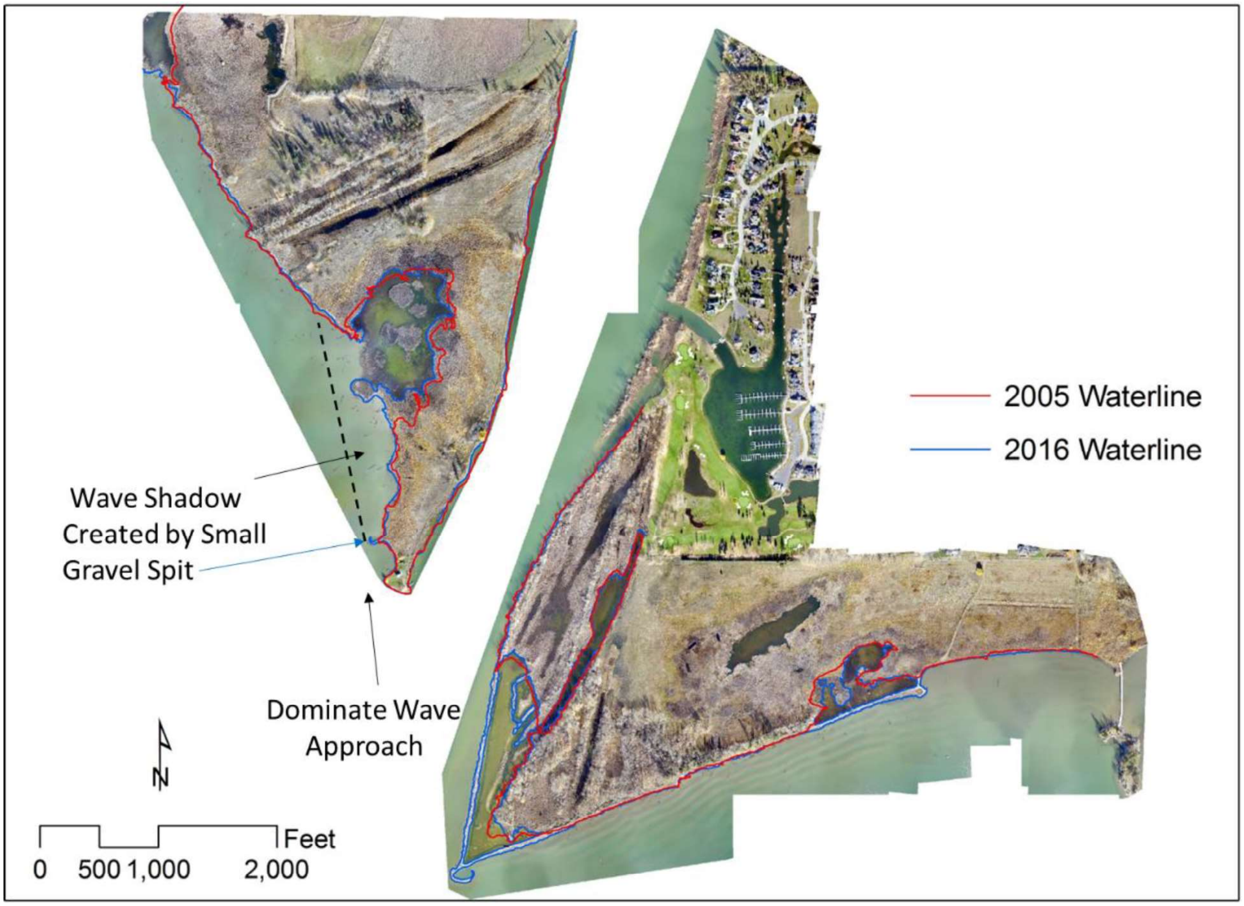


Figure 2. This is a 2016 drone image of the north showing the USFWS Waterfowl Production (WPA) and comparison of the 2005 shoreline (red) with the 2016 shoreline (blue). Offshore gravel bank/beach structures on the east side of the river mouth were built to protect the backshore environment from wave erosion. The shore attached beaches are barely visible at this scale. As designed the small gravel spit built on the west side cast a large wave shadow from the dominant southern wave climate. This structure played a significant role in stabilizing the shoreline resulting in accretion of new wetland habitat. This report focuses on the change since this 2016 condition.

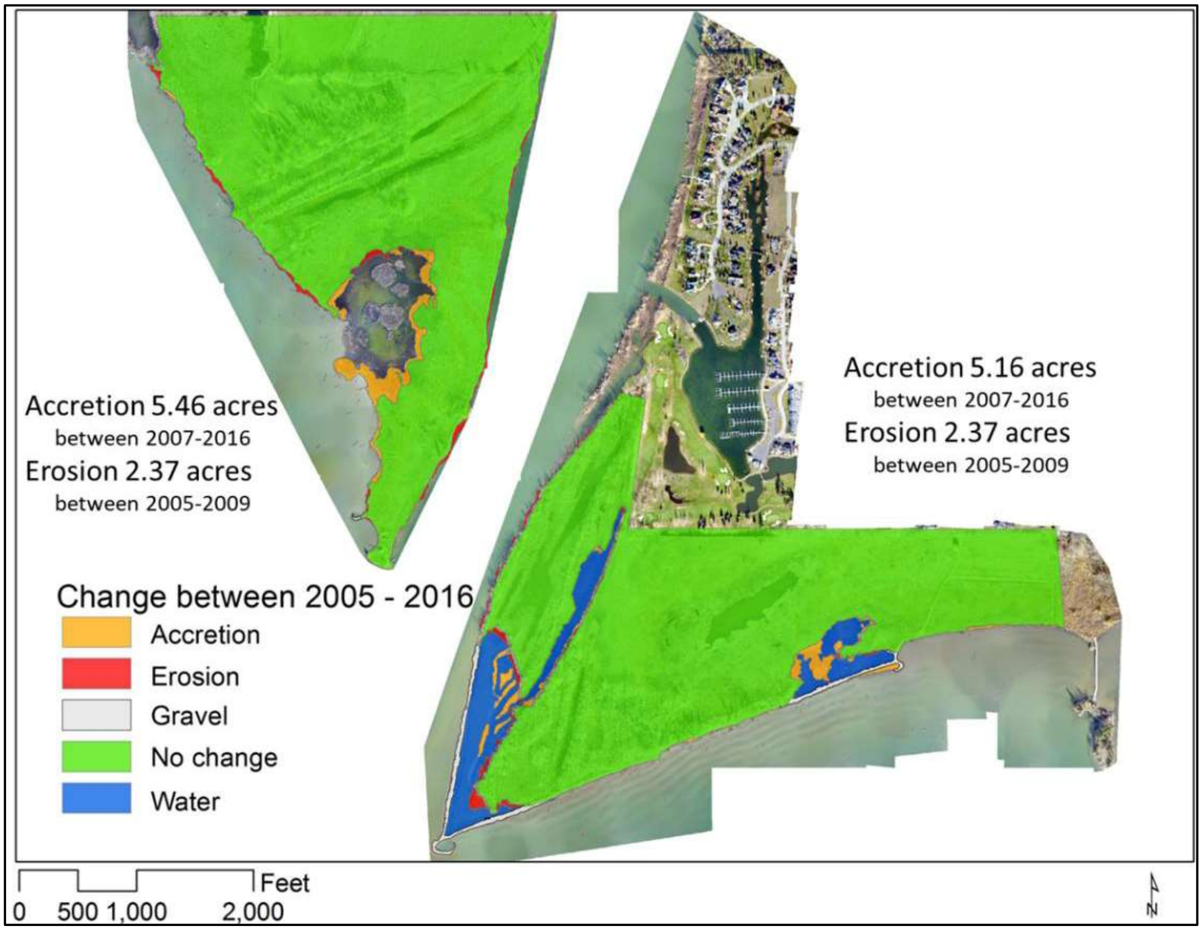


Figure 3. This is a 2016 habitat map created from the 2016 drone image of the USFWS Waterfowl Production (WPA). The red areas show shoreline erosion and land loss areas between 2005 and completion of the erosion control gravel beach system by 2012.

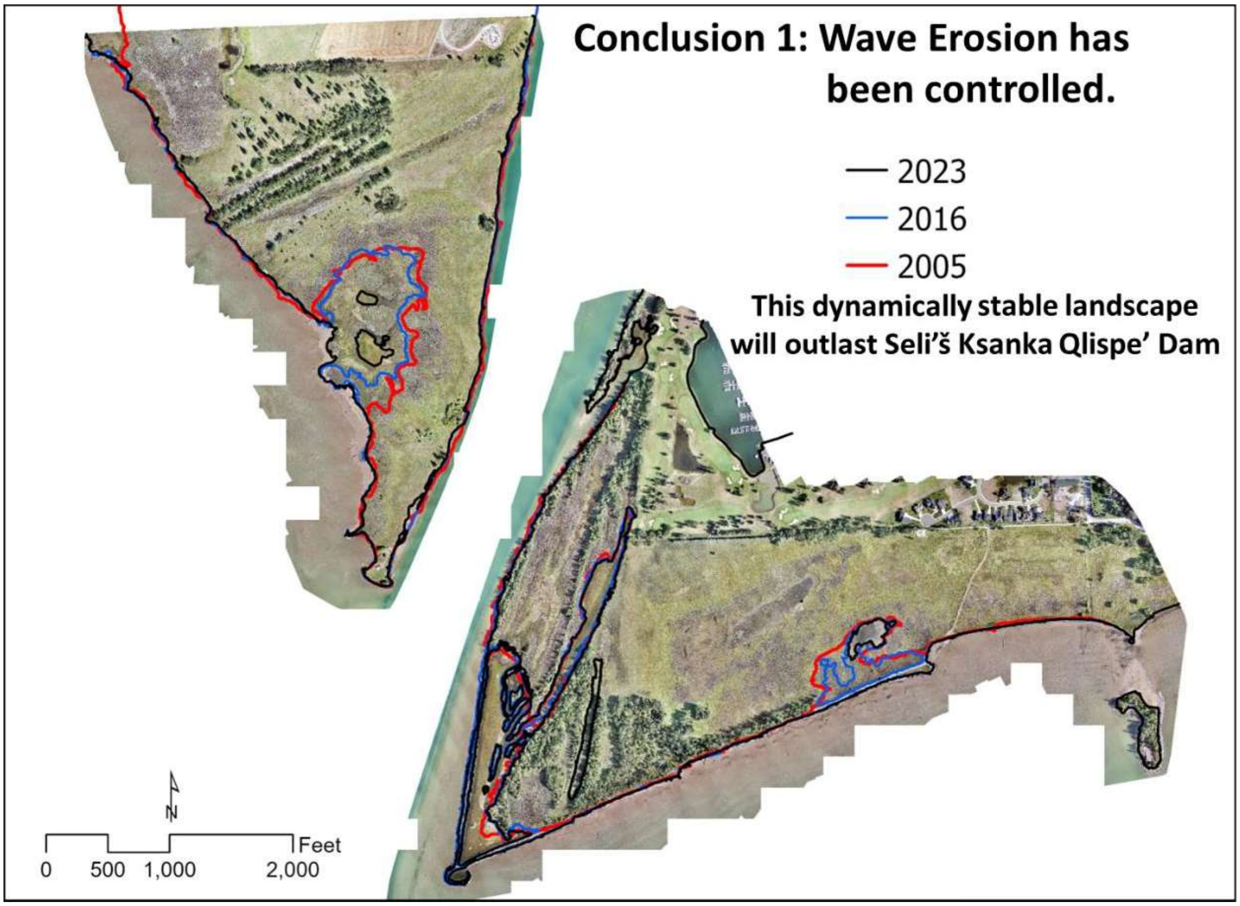


Figure 4. This is a 2023 drone image of the north showing the USFWS Waterfowl Production (WPA) and comparison with the 2005 shoreline (red) with the 2016 shoreline (blue) and 2023 shoreline (black). No wave erosion has resulted in a loss of land over the decade since erosion control structures were completed in 2012. The conclusion drawn and supported by further monitoring data suggests that the WPA gravel beach system has reached a state of dynamic stability.

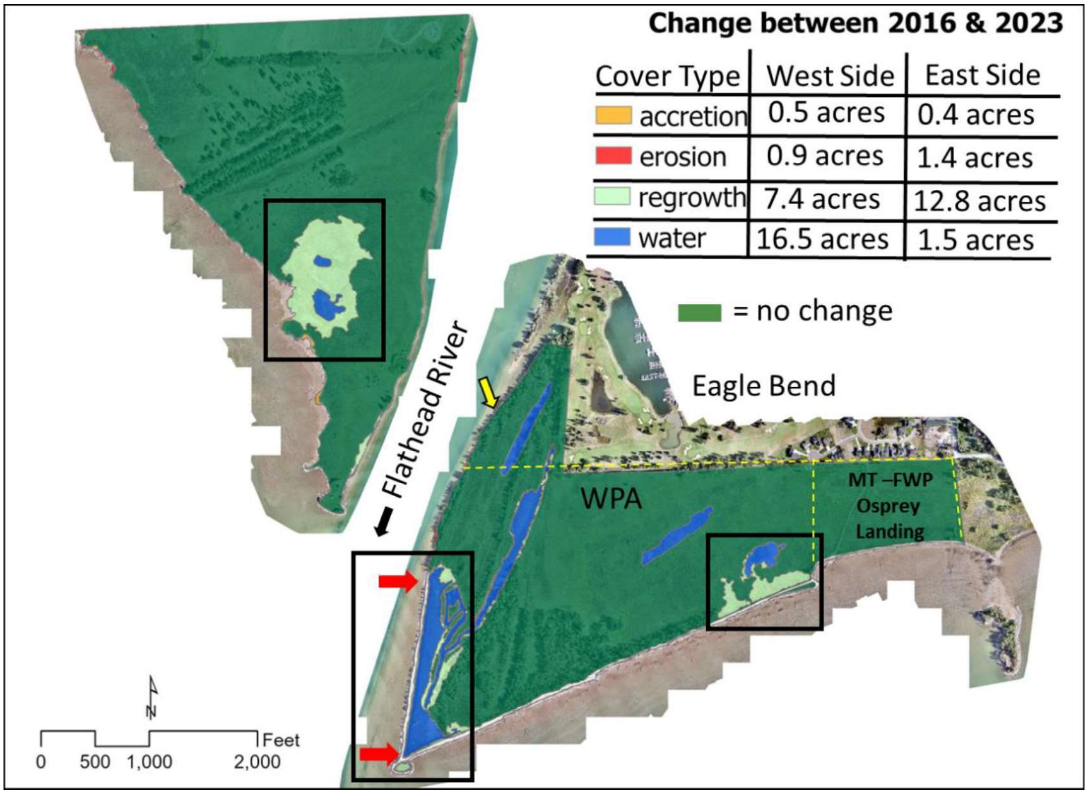


Figure 5. This is the 2023 habitat map created from the 2023 drone image of the USFWS Waterfowl Production (WPA). A little over 20 acres of wetland plant regrowth has occurred since completion of erosion control structures (Table inset). The most regrowth has occurred in the two square black boxes with the least regrowth occurring behind the offshore gravel bank on the east side of the river mouth (black rectangle). Red arrows show where cobble plugs were built as the last item in 2012. These plugs of cobble material should be removed to allow the levees behind the gravel banks to function as riverine flood channels as originally designed. The yellow arrow shows where the natural levee breach has been widening further enhancing the connection between the river and backshore water behind the dike.

Figure 6. This photograph is of the gravel beach located near piling G (see figure 9) on the lakeward side of the offshore structure on the east side of the river mouth. The river brings logs into the lake that disperse as a function of currents and waves. Waves push the logs ashore and then rework and sort the gravel creating a gradation in size from coarse cobbles lakeward where wave-breaking processes occur to finer gravel, logs and woody debris forming the shoreline against the vegetated bank. This dynamic gravel beach zone is where waves and regulated lake levels coupled with recolonization of wetland and riparian plants work together to form a constantly shifting mosaic of shoreline habitat. These processes maintain an important structural and functional outcome for a healthy nearshore ecosystem in Flathead Lake just as they do in gravel-bed rivers (sensu, Stanford, Lorang and Hauer 2005).

Stanford, J.S., M.S. Lorang and F.R. Hauer. 2005. The shifting habitat mosaic of river ecosystems. *Verh. Internat. Verein. Limnol*. 29.

Conclusion: 3

Dam operations coupled to the wave climate drive gravel beach dynamics that plants adapt to. That interplay drives a shift in the mosaic of shoreline habitat which is an important functional outcome for a healthy nearshore ecosystem of Flathead Lake. Deposition of logs, fine wood chips and wind blow sand coupled to wave action reshaping the gravel beach continues to create and reshape this shifting mosaic of shoreline habitat (Figs. 7 and 8). Wave action moves logs and gravel around as measured with imagery and by defining the outer edge of the logs with the lake as the shoreline. This is the cut-and-fill process we measure with imagery and that is driven by lake level regulation and wave action that plays out as a dynamic gravel beach (Fig. 6).

Figure 7. These photographs show the dynamic gravel beach on the lakeward side of the offshore gravel bank (top near piling G) compared with the inside shoreline of the gravel bank that is not exposed to wave action (bottom). Piling G corresponds to Transect G where survey data were extracted from the 2017 Lidar DEM and the 2016 and 2023 DSM.

Figure 8. This photograph shows windblown sand deposited on to the exposed gravel beach and backshore of the bank. This process occurs in the spring during lake drawdown and is an important component in the shifting habitat mosaic of the WPA shoreline.

Conclusion: 4

The offshore dikes were built to provide new habitat for waterfowl behind them. The outer spit where the dikes join has withstood the past decade (built in 2012) of wind-waves, boat wakes and river currents. Profile plots from transect data collected from seven monitoring locations show that the lakeward dikes exposed to wave action shift between erosion and accretion as a function of storm wave action and the delivery of logs from the river (Figs. 9 - 11). The dikes themselves are dynamically stable (Figs. 9 - 11). Unfortunately, the area behind the offshore gravel dikes has not responded as well in terms of regrowth of aquatic plants as other areas (Fig. 5, compare regrowth in areas defined by the black boxes).

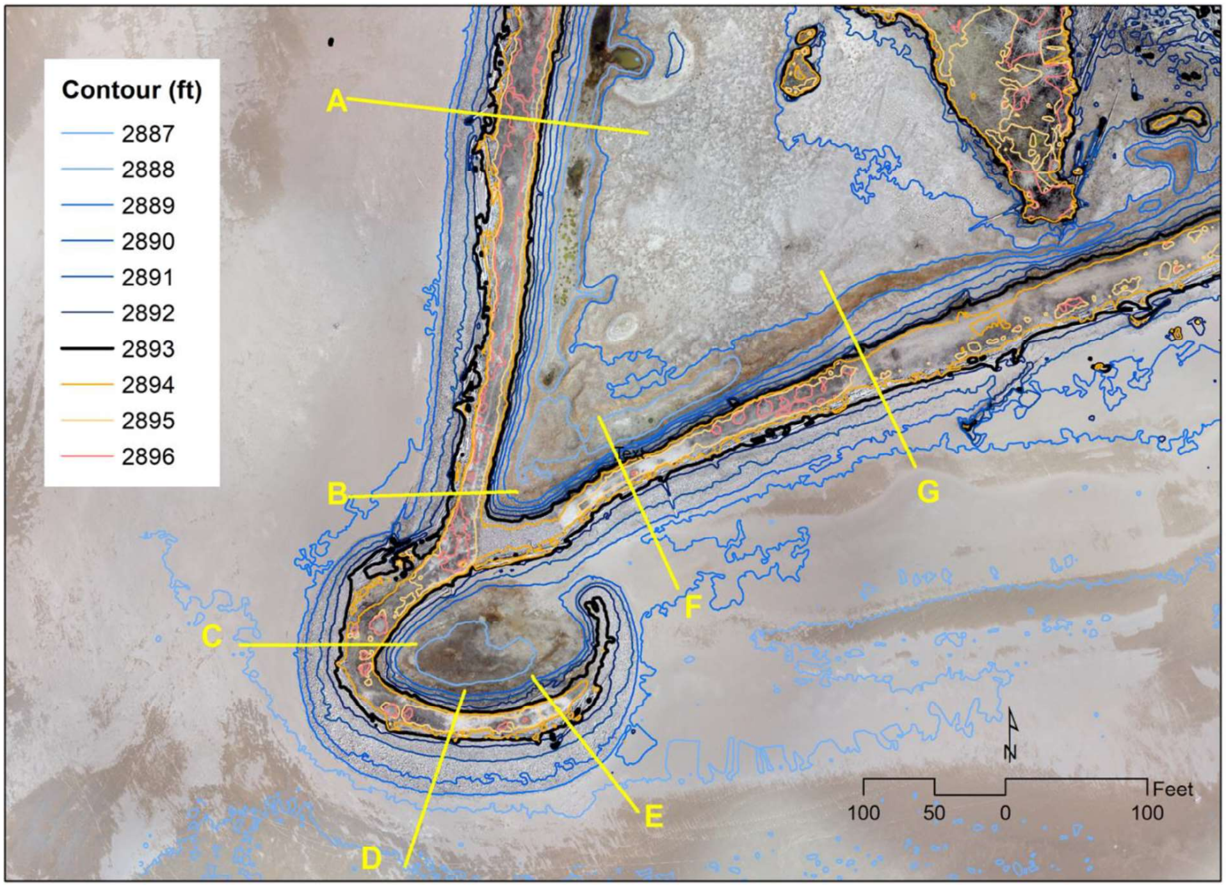


Figure 9. This is a 2023 aerial image of the spit on the eastern river mouth area. The elevation contours were created from the DSM. The black line is the 2893 ft contour. Transect lines A-F (yellow lines) show locations where data was extracted from the 2016 DSM, 2017 Lidar base and 2023 DSM for comparison. Profile plots of that data extracted from those transect locations are shown in figures 10 and 11.

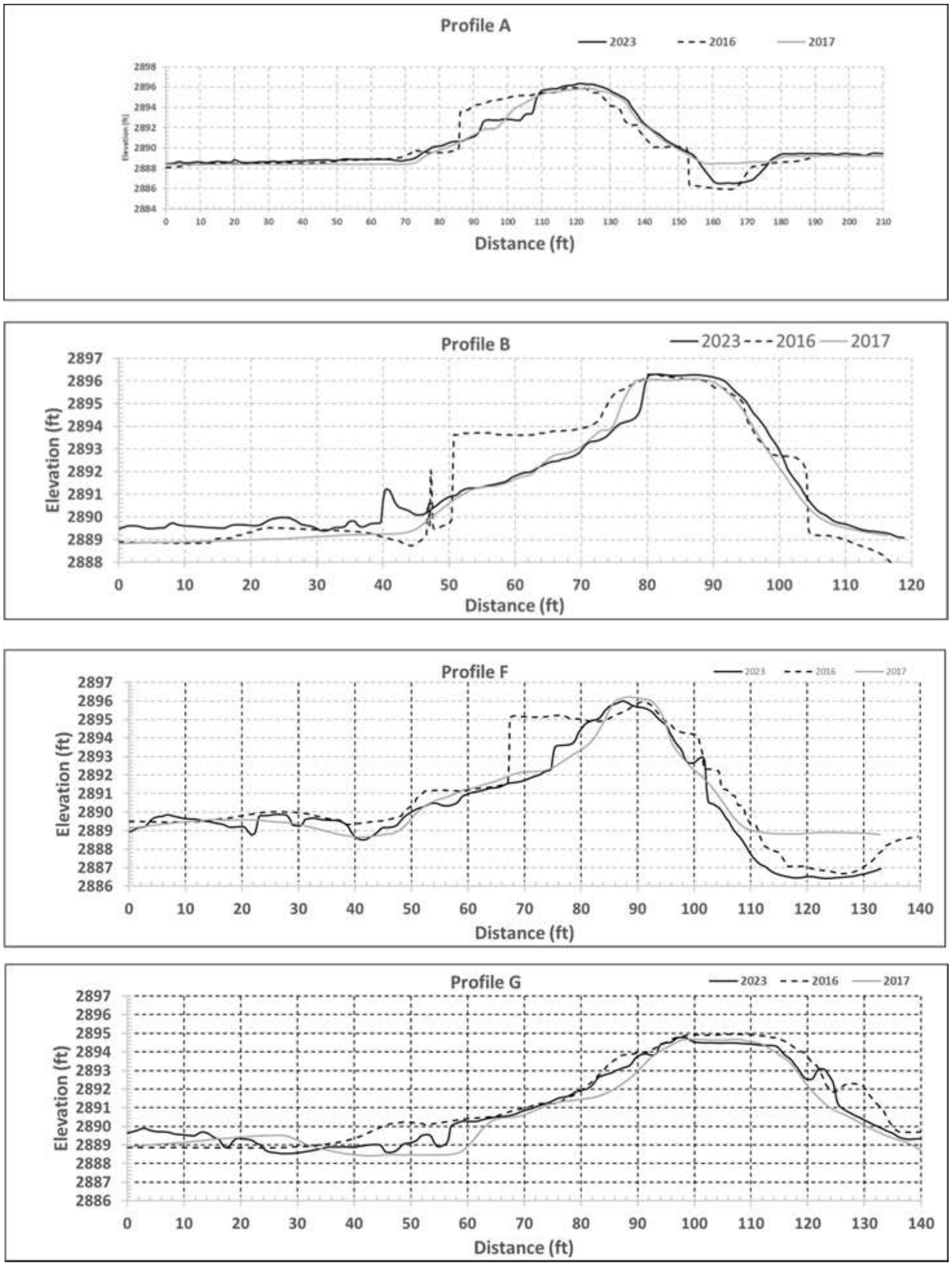


Figure 10. These panel plots correspond to the transect lines shown in figure 9. 2016 and 2023 profiles were aligned with the 2017 Lidar base given its higher accuracy. Note the high dotted lines for 2016, these are an artifact created by the vertical poles that underscore the "blanket effect" discussed in the methods. Profile B shows the most erosion since 2017 although this area could breach it is highly unlikely as the wave-cut portion is at an elevation of 2894 ft whereas the bank below that is stable. It is most probable that waves lack sufficient energy to erode completely through the top layer of the dike which is composed of silt and sand placed on top of the gravel bank. Wave energy has been nearly completely dissipated hence wave erosion has cut as deep as it can.

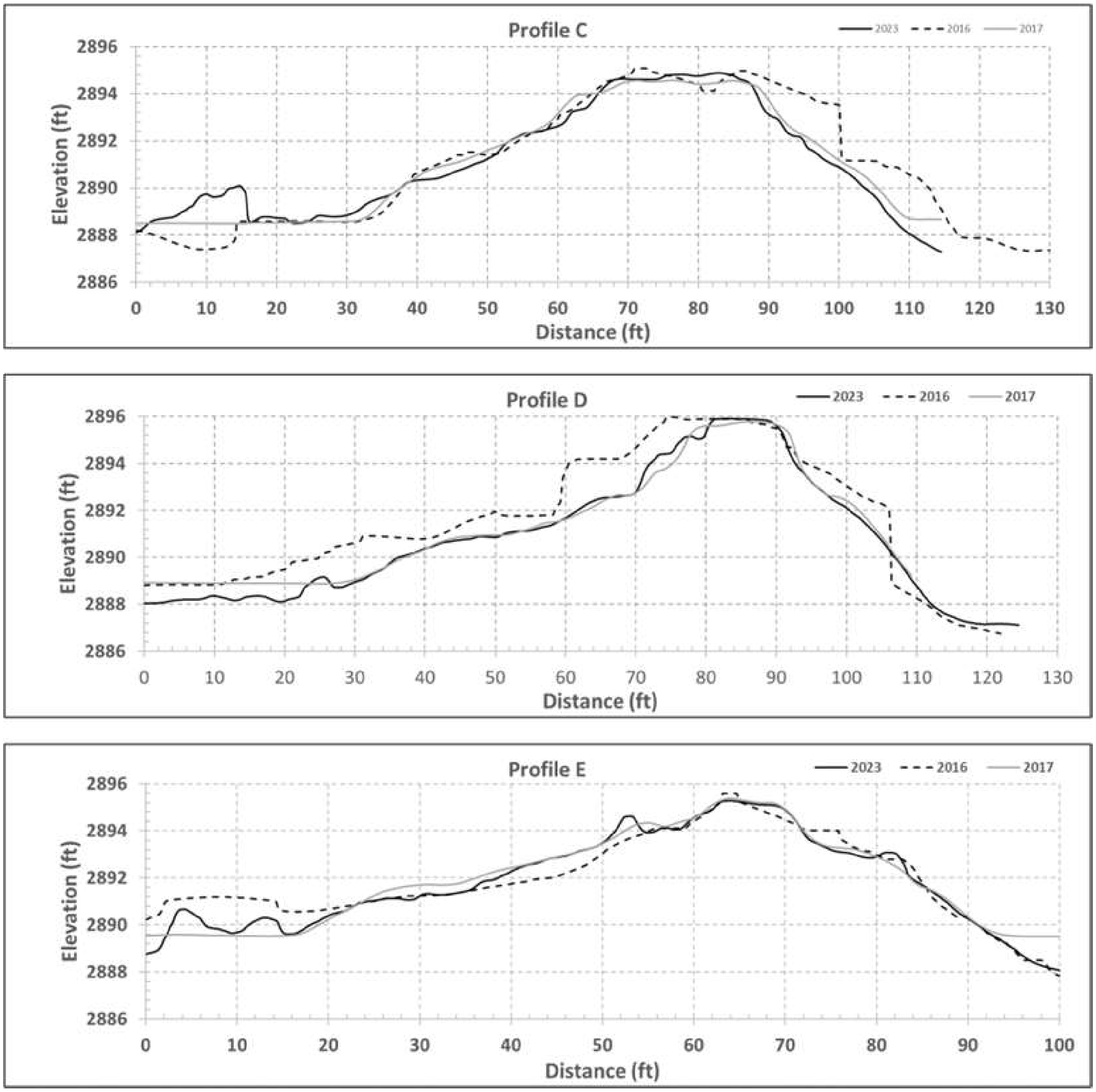


Figure 11. These panel plots correspond to the transect lines shown in figure 9. 2016 and 2023 profiles were aligned with the 2017 Lidar base given its higher accuracy. Note the high dotted lines for 2016, these are an artifact created by the vertical poles underscore the "blanket effect" discussed in the methods. Profile D is the most exposed to waves on the outer edge of the spit and it shows the most erosion since 2017 although this area could breach it is highly unlikely as the wave-cut portion is at an elevation of 2894.5 ft whereas the bank below that is stable. It is most probable that waves lack sufficient energy to erode completely through the top layer of the dike which is composed of silt and sand placed on top of the gravel bank. Wave energy has been nearly completely dissipated hence wave erosion has cut as deep as it can.

Conclusion: 5

The breach in the river levee above the North Shore restoration project (see figure 5 for location) on the East side of the river has widened since 2017 due to erosion undercutting tree roots (Fig. 12). This ongoing bank erosion process is a good outcome that will allow an increasingly free exchange of water and fish as bank erosion continues to widen the levee breach. Considering the existing leave breach, the cobble plugs (Fig. 13) placed to keep out Northern Pike from the restored river sloughs and ponds should be removed to allow water to flow freely and the restoration project to function naturally as originally designed. That material could be reused on site (Figs. 14). This area was formed pre-dam as riverine flood channels connected to the mainstem and carrying flow. The other areas (black boxes 1 & 2 figure 5) were spit embayment's with lots of organic deposition that encourages wetland restoration naturally (Figs. 4-5, 7).

Figure 12. These photographs show erosion of the natural levee above the WPA (see figure 5 for location). The one on the left is from 2017 and on the right from 2023. The red arrow points to a tree common to both photographs. The white circles show the collapsed bank in 2017 that has been completely washed away and now the birch tree that the red arrow points to in the 2023 photograph has become undercut by wind-waves, boat wakes and river currents. This process will continue allowing water and fish to freely reach the water behind the offshore dike.

Figure 13. This 2023 photograph shows the cobble-barrier near the spit. It prevents northern pike from accessing the back water and using it for spawning. This barrier also severely limits the exchange of water. Water behind the dike becomes very warm in the summer creating a water quality issue for the lake and limiting the regrowth of aquatic and wetland plants. This cobble material should be removed and allow fisherman to harvest north pike as a means of controlling their population.

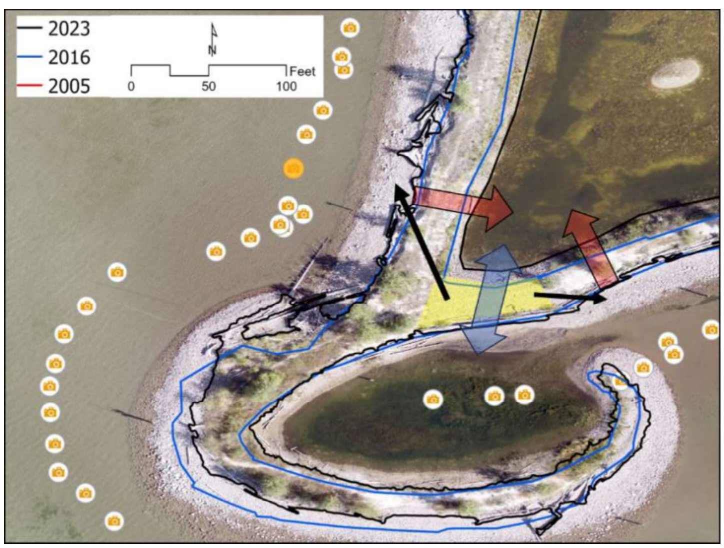


Figure 14. This 2023 aerial image of the river mouth spit is from the August oblique drone imagery. Each photo icon represents the location of an oblique aerial image that can be downloaded and examined as part of the ArcGIS database. The red arrows show potential surface breach locations. The yellow polygon delineates the cobble fill placed to prevent pike from accessing the water behind the dikes (see figure 13). The blue double arrow shows where water exchange was originally designed to occur. The black arrows show where cobble material could be placed if the cobble-barrier was removed with an excavator. This action would also allow boat access. There is another cobble-barrier on the northern end of the dike which should also be removed to allow water exchange and boat access.

Conclusion: 6

The recognition of the seasonality in the occurrence of wave-storm events (Fig. 15) led past dam operators to change the way they regulated lake levels (Fig. 16 right panel). This recognition of storm seasonality resulted in lake drawdown to an elevation of 2891 ft to limit wave erosion from fall storms. That drawdown started after Labor Day (Fig. 16).

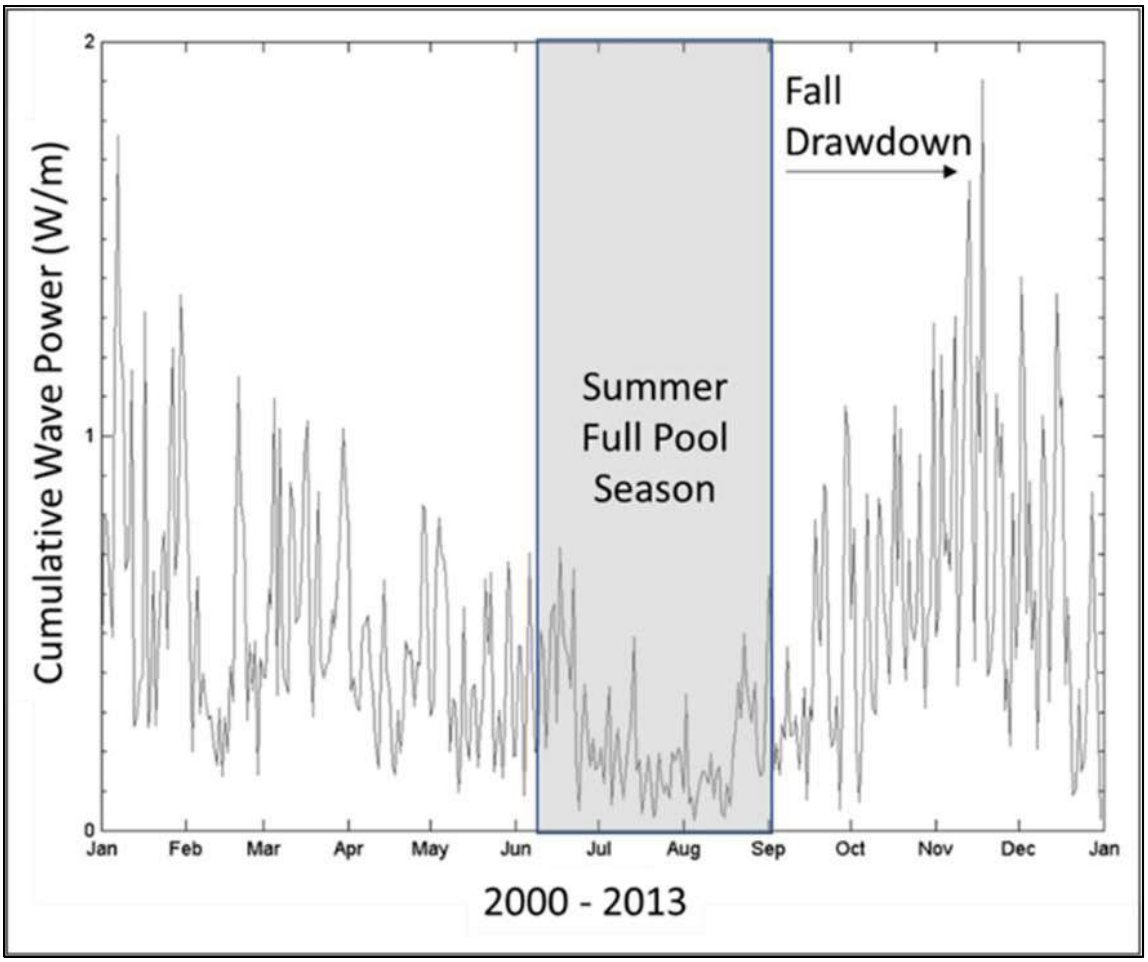


Figure 15. This schematic is a plot of cumulative wave power calculated on 15-minute intervals over the years 2000 to 2013 defines seasonality in the magnitude of storms. Summer Full Pool season has the lowest wave power compared to fall and winter. This graph provided information to the power companies that lowering the lake level in the fall would help reduce wave erosion lake wide.

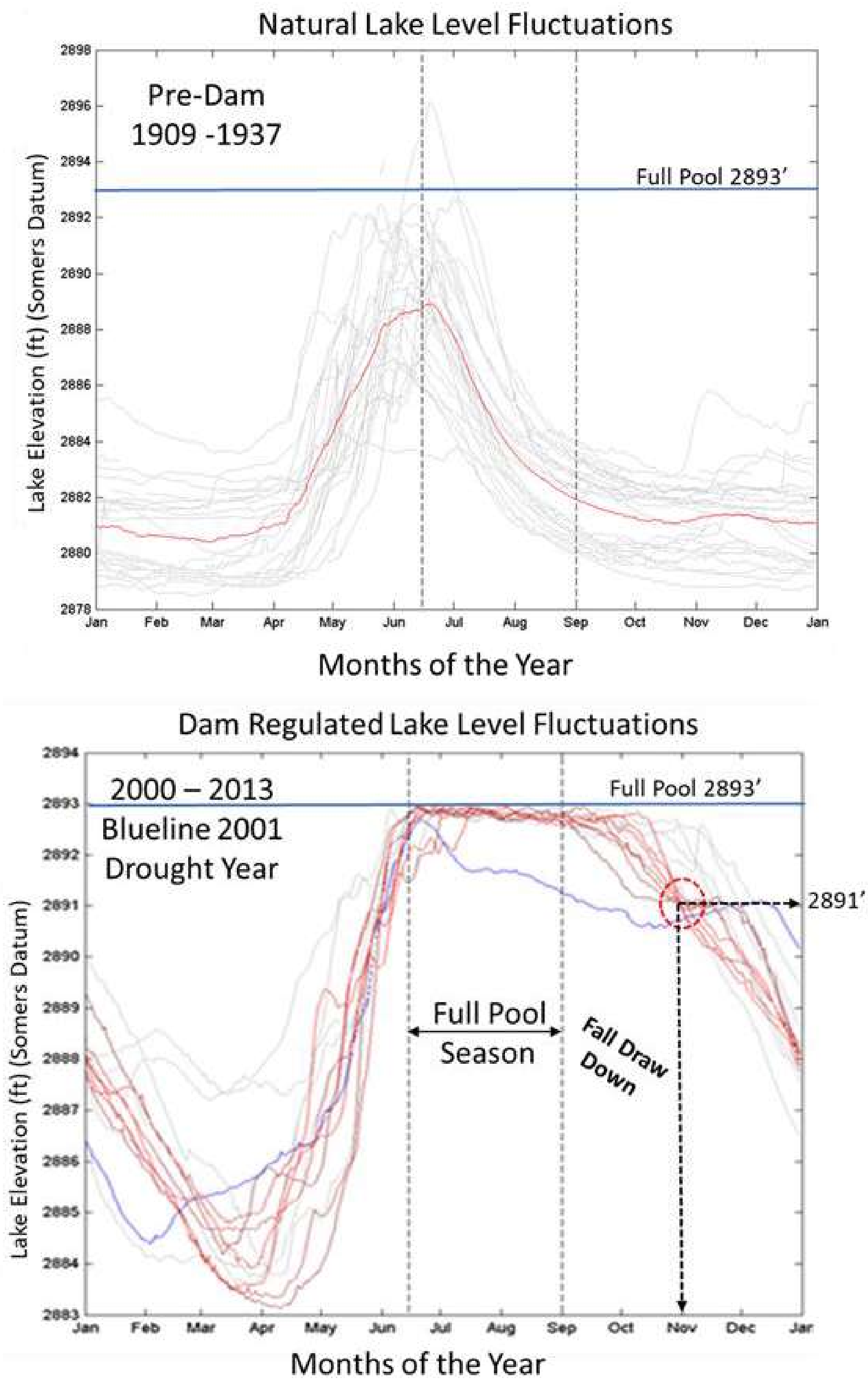


Figure 16. These two panel plots compare nature lake level fluctuations (top panel) to dam regulated lake levels (bottom panel). The decision was made in 2007 to draw down the lake level after Labor Day to an elevation of 2891' by November 1 (red lines). The grey lines show lake regulation from 2000 to 2006. During this maximum erosion period the dam operators regulated the lake with little regard for the harmful effects of wave erosion. The period of erosion mitigation (2007 to 2013) was an attempt to reduce wave erosion from fall storms lake wide by lowering the lake.

Conclusion: 7

EKI operations of *SKQ* Dam differ slightly in that drawdown begins much earlier around the end of June and continues until November 1 when the target 2891 ft elevation is reached (Fig 17).

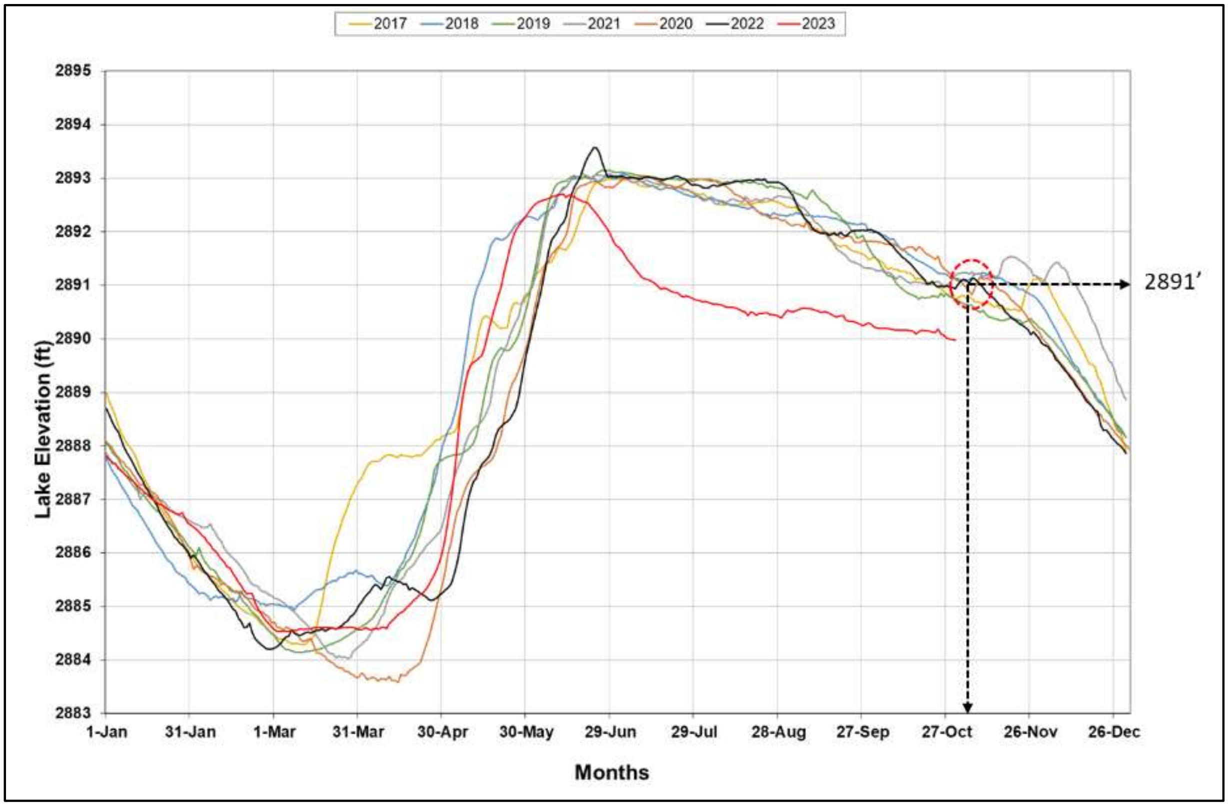


Figure 17. This line graph shows lake level regulation under dam operations by Energy Keepers Inc. Their approach is to bring the lake up to 2893’ by June 15th as contractually obligated. This can only happen if the watershed delivers enough water. Both drought years, 2001 (blue line figure 16 bottom panel) and 2023, the watershed did not deliver enough water to fill Flathead Lake to 2893’ by June 15th. *EKI* starts an early drawdown beginning soon after June 15th to 2891’ by November 1, except for the 2023 drought year when the lake hit 2891’ by end of June. The 2023 hydrograph shape is much closer to the mean lake level change occurring under natural un-regulated lake levels (Fig. 16 top panel) which greatly reduces wave erosion and harm caused the nearshore zone of Flathead Lake.

Conclusion: 8

Lake level regulation in 2022 and 2023 spans the range of lake level regulation since dam operations began in 1938 (Fig. 18). The vertical distribution of wave power relative to these lake level regimes shows that EKI operation significantly reduced the amount of annual wave power to 17.7% and 15.1 % respectively for 2022 and 2023. This reduction would have the effect of significantly reducing wave erosion lake wide.

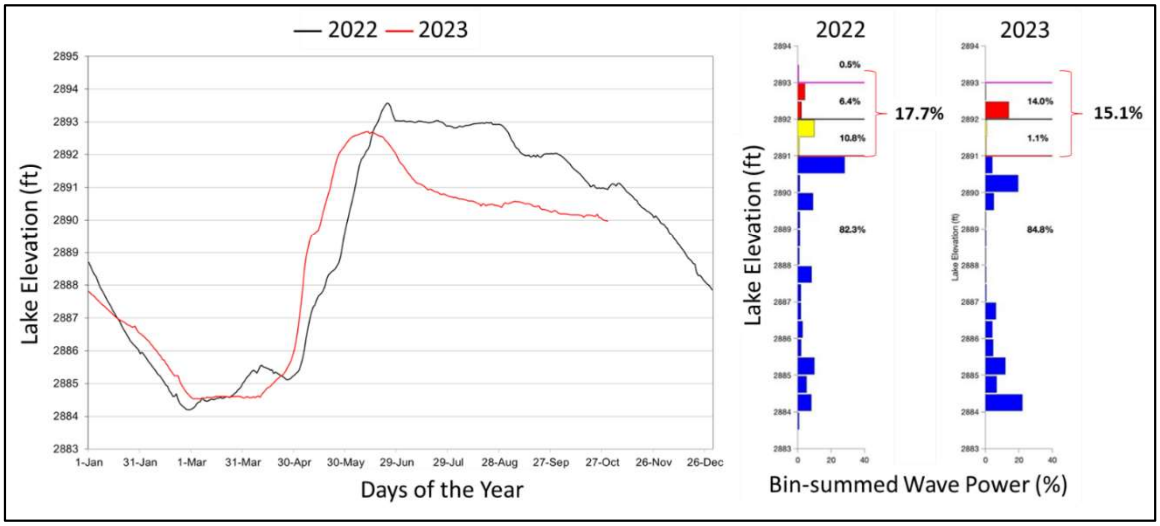


Figure 18. This panel graph shows lake level regulation under dam operations by Energy Keepers Inc. for the two years that span the lake level regulated regime since dam operation began in 1938 (left panel). The 2022 freshet release of water exceeded the capability of the dam to release water and keep the lake from exceeding 2893' (bump in the black line). The vertical distribution of wave power above 2891' was very similar, 17.7% versus 15.1% for each year and considerably less than the previous two decades of lake level regulation that distributed 67% and 31% of the wave power above 2891 ft.

Conclusion: 9

Linking lake level regimes since 2016 with the occurrence of wind-wave storms requires using measured wind data (speed and direction) to make hindcast estimates of wave power correlated with lake levels (Fig. 18 right panel, & Figs., 19 & 20). Wave energy can then be tallied, or bin-summed, relative to lake level and categorized into the percent wave energy per lake elevation (Figs.18, 19 & 20).

Lake level regimes during wet years like 2022 will continue to occur in the future as well as drought years like that experienced in 2001 and 2023 (Figs. 16, 17 & 18). If drought conditions become the future norm, then lake level regimes like experienced in 2023 will also become the norm. That will result in less wave erosion and more net habitat regeneration lake wide including the upper river as both aquatic and riparian plants respond to a decrease in wave power due to a lake level regime that more closely mimics the natural pre-dam conditions.

Conclusion: 10

The Energy Keepers have managed the dam, in terms of reducing wave erosion lake wide better than previous power companies (Figs. 19 and 20, e.g. 31% for the erosion mitigation period vs 21.5% under *EKI* operation). Moreover, *EKI* has accomplished this despite two extreme back-to-back water years that span the range over the past 85 years of drainage basin discharge.

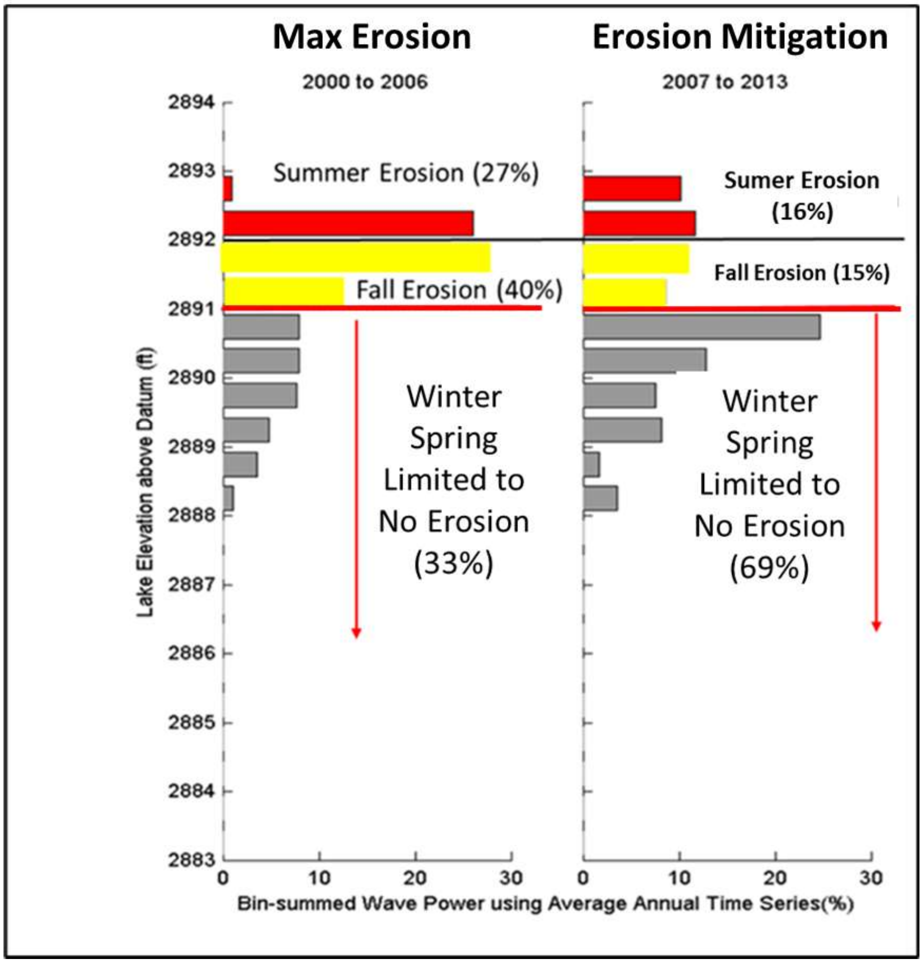


Figure 19. These two panel graphs show histograms of how different dam operations vertically distributed wave power corresponding to lake level regimes shown in figure 16. The graph on the left panel corresponds to the lake level regimes described as the maximum wave erosion period because fall storms were not a concern. During 2000-2006 67% of the annual wave power was focused on lake levels that create the most erosion. From 2007 to 2013 the power company became aware that wave erosion could be decreased by drawing the lake down to 2891 ft before the fall storms hit. That six-year regime resulted in 31% of the annual wave power being focused on lake levels that creates the most erosion. This erosion mitigation period saw > 50% reduction in wave power compared with the maximum wave erosion period.

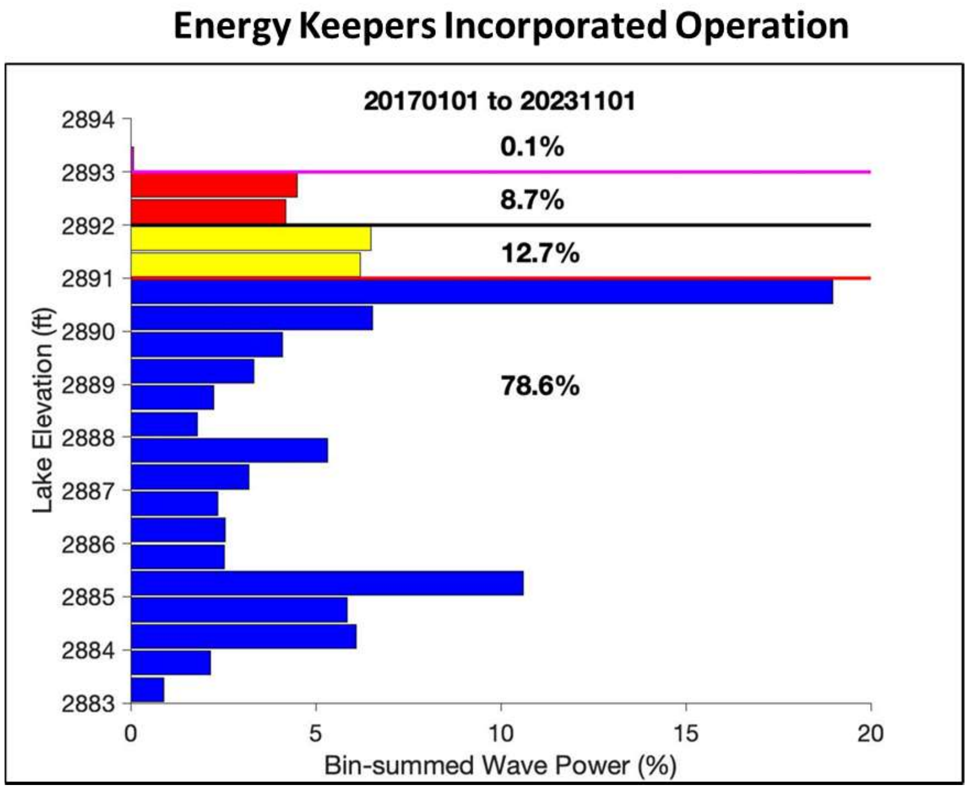


Figure 20. This histogram shows the vertical distribution of wave power over the past 6 years Energy Keepers Inc. have operated *SKQ* dam. They reduced wave power that causes erosion to 21.5% compared to 31% and 67% of wave power that previous dam operations concentrated at erosion levels (red and yellow bars). EKI does this to reduce harm caused by dam operations to the nearshore zone of Flathead Lake while also reducing harm to the lower river while creating profit for the *CSKT* people, in keeping with their mission.

Additional Detailed Results Supporting the Conclusions

This section provides a more detailed analysis of data that further supports the conclusions presented above.

Linking Lake Level Regulation and Wind Wave Events and Measured Beach Response:

Monitoring of lake level regulation and wind-wave events starting in 2016 continued throughout the 2023 full-pool season to November 1, 2023 (Fig. 21). The first step is to calculate wave power on 15-minute intervals corresponding to lake level reporting by the USGS (Figs. 21 & 22). Linking wave power during years and seasons as well as individual storm events to beach response is difficult without having a corresponding monitoring program documenting how beaches respond. Linking wave power to beach response requires monitoring beach response on the same interval as wave power and lake levels which was done in 2016 as part of the initial report to *EKI* (Fig. 23 & 24). That analysis is important because it underscores the impact that lower lake levels have on how storms impact the erosion control beaches.

However, to evaluate beach response to the vertical wave power distribution (Fig. 22) requires using beach response data collected at other locations than the WPA lands. Hence, details regarding lake levels, wind wave events and subsequent beach response are included here that come from the publicly available monitoring data from Somers Beach State Park for MT FWP (Figs. 25 – 32). This data is particularly important because it covers the two years of extreme lake level variance, 2022 and 2023 (Figs. 25-32).

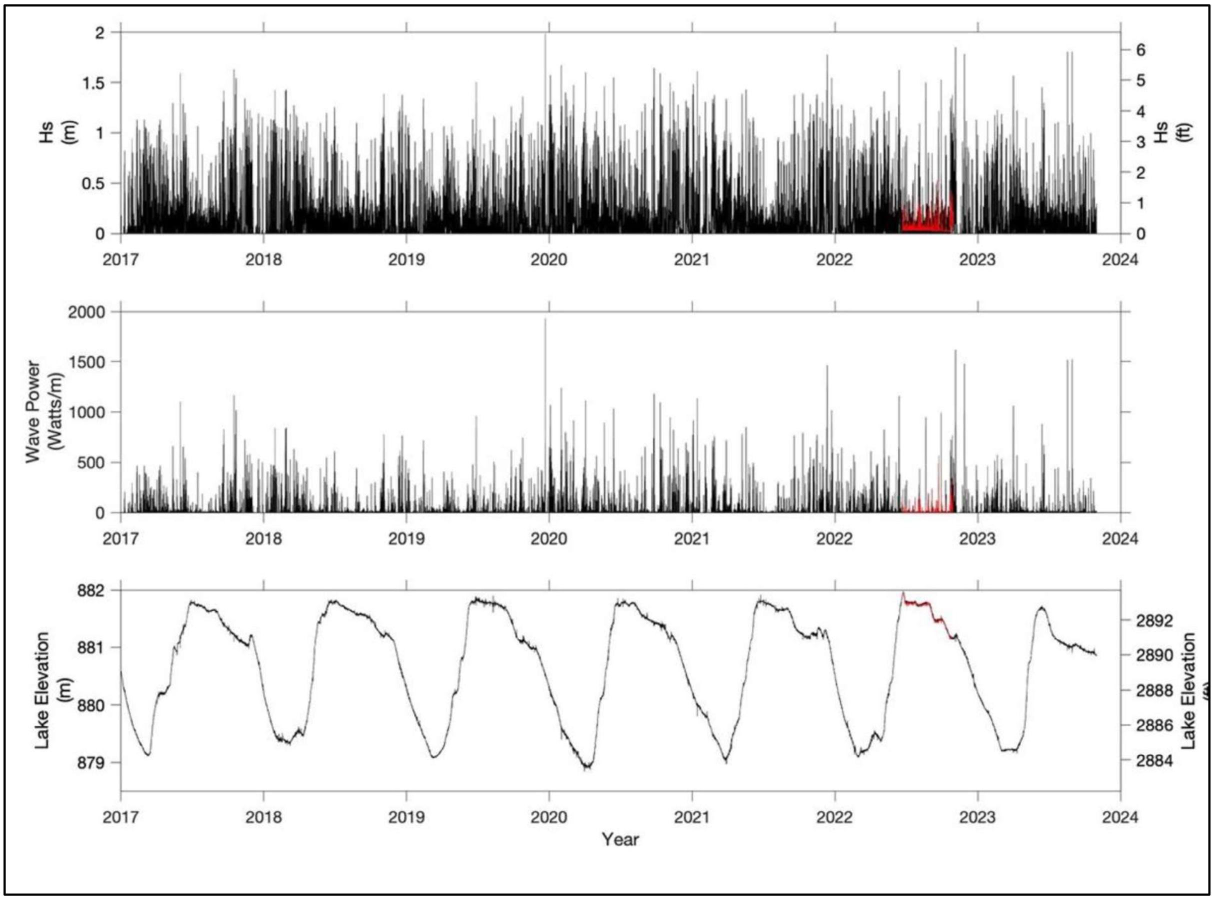


Figure 21. These three panel graphs show hindcast estimates of significant deep water wave height (top panel) with corresponding wave power (middle panel) and the USGS measured lake levels corresponding to the duration for *EKI* operation of *SKQ* dam. The red lines in the top panel are from wave data collected as part of the Somers Beach State Park project near Somers, which is a north shore community west of the WPA. Modeled deep water wave height is greater than measured wave heights (compare black lines to red lines for 2022). This is because the black lines are for deep water wave height and the red lines are from a wave gauge fixed to the bottom but close to shore therefore that instrument is not measuring deep water wave heights, but wave heights close to shore after the deep-water waves have broken and reduced their height before traveling across the wave gauge.

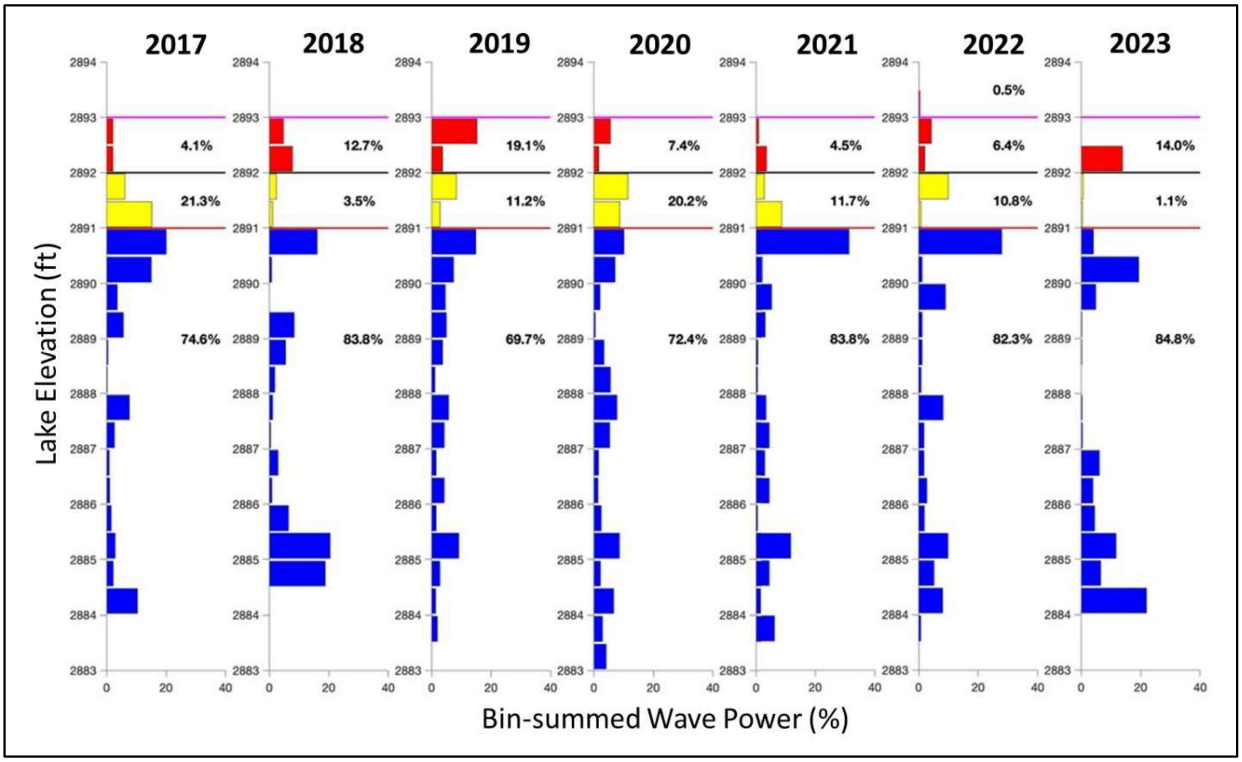


Figure 22. These seven panel graphs show histograms of how different dam operations vertically distributed wave power relative to the occurrence of wave events figure 21. The yellow and red bars indicate wave power that results in wave erosion.

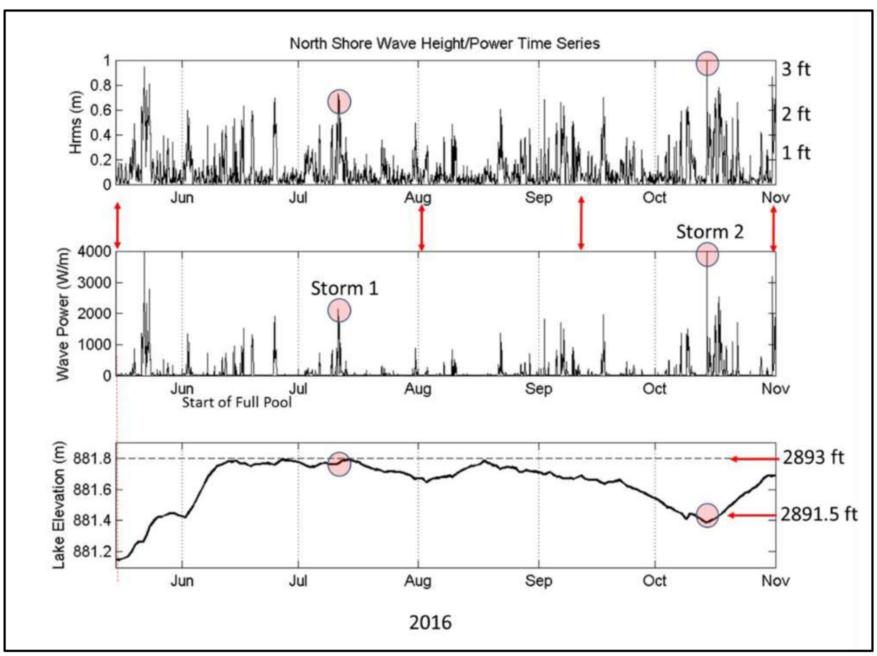


Figure 23. These three panel graphs are for the first year of *EKI* operation (2016). Two storm events have been identified that correspond to foot-surveys conducted that year at the upper and lower limits for erosive wave power quantified in figures 18-20 & 22.

Figure 24. These two photographs show the beach's response to waves associated with the storms identified in figure 23. The photo on the left is from a storm occurring very close to full pool lake level of 2893' and shows how far waves reached up the beach and into the riparian plants trying to advance lakeward. The photo on the right shows how a lower lake level created the situation where larger storms with significantly more wave power could not reach up into the riparian fringe of the gravel dike.

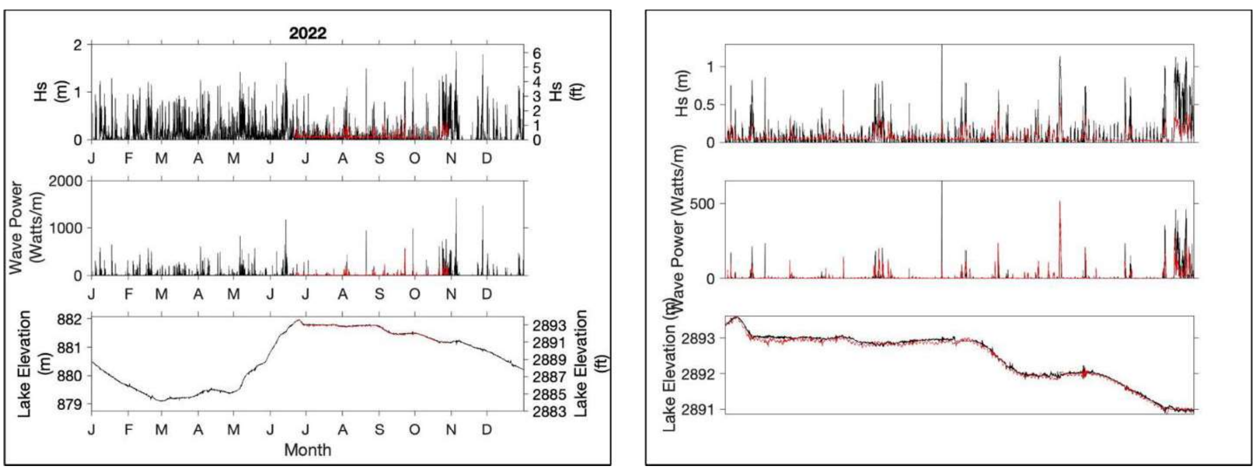
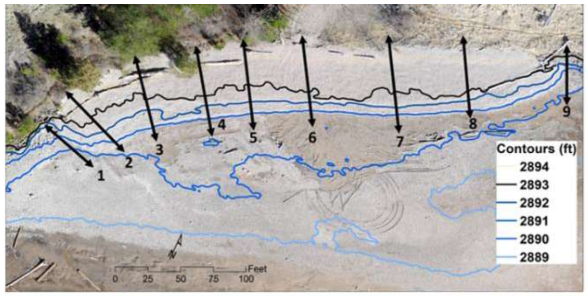


Figure 25. These two panel graphs show occurrence of wave events relative to regulated lake levels during 2022 which was a wet year that created the situation where lake level exceeded 2893'. The data from the wave gauge is plotted in red. The model estimates are for deep water conditions and the wave gauge was deployed further inshore. The gravel beaches constructed at Somers Beach State Park were constructed during spring drawdown in 2022 and initially exposed to this uncommon high-water level. However, the beach responded to this situation as expected with waves reworking the placed gravel creating a beach step and crest (Fig. 26 lower panel and Fig. 27).



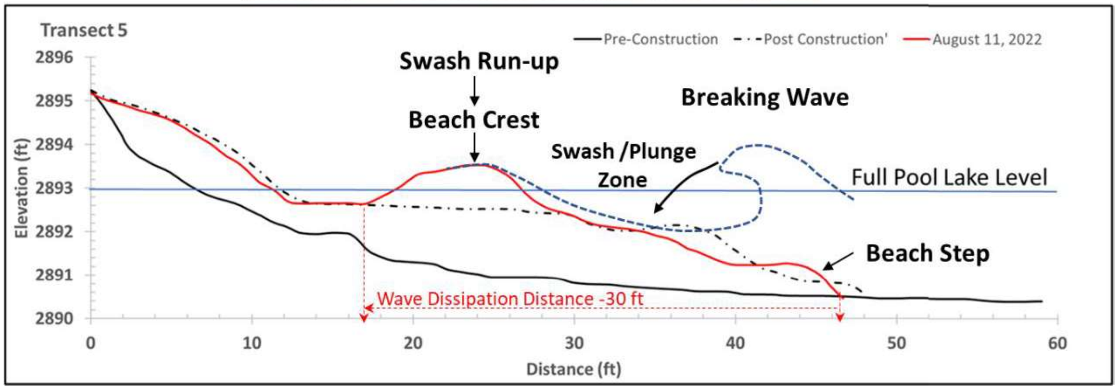


Figure 26. The top photograph shows the transect locations at Somers Beach State Park. Transect 5 data is plotted for the post construction survey (black dash-dot line) and the post storm wave reworking of gravel into a beach step and a beach crest. The photograph of the beach and beach crest is shown in figure 27.

Figure 27. This photograph is of the swimming beach at Somers Beach State Park that corresponds to the survey data shown in figure 26. That material reworked by waves and deposited on top of the constructed beach material is identified by the white bracket which is the beach crest shown in figure 26. This beach crest is the product of the 2022 season of wave power shown in figures 22 & 25.

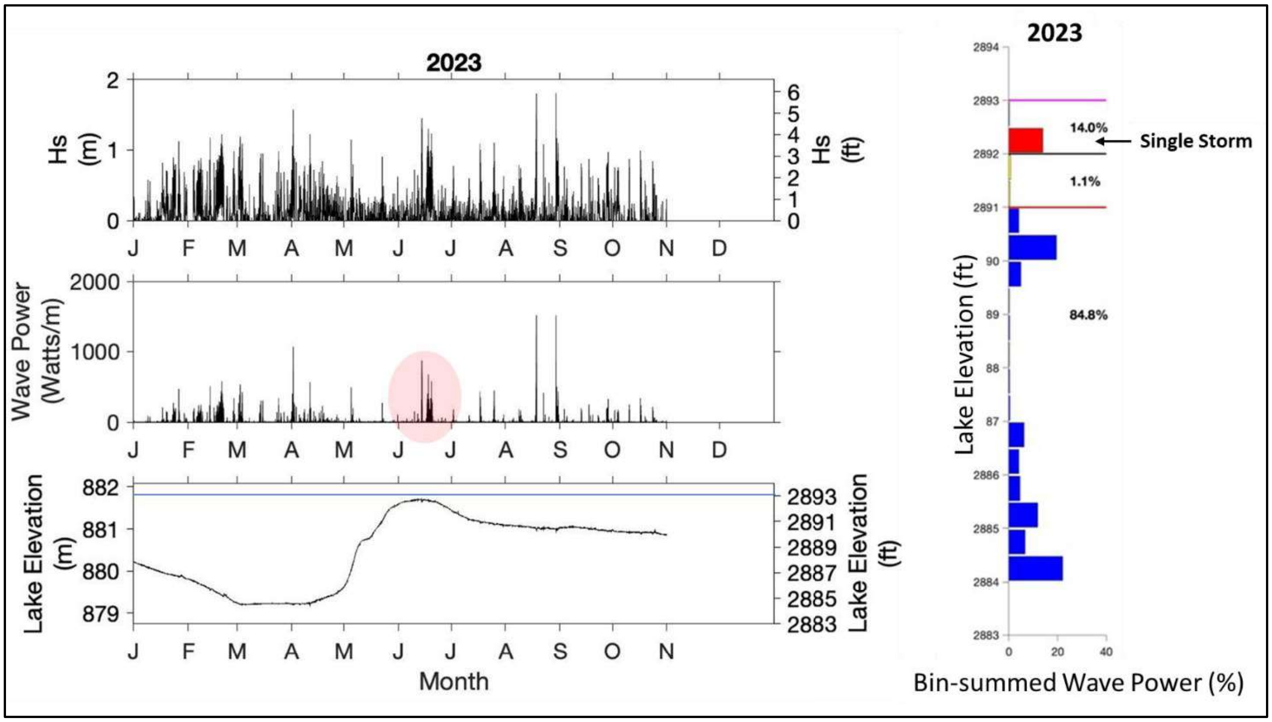


Figure 28. The panel graph on the left shows the occurrence of wave events relative to regulated lake levels during 2023 and the panel graph on the right shows the resultant vertical distribution of wave power due to the occurrence of storms relative to lake level. The single storm event (red circle) in the left panel is responsible for 14% of the annual wave power, through October 2023. Figures 29 to 32 depict the response of the gravel beach and the fringing wetland marsh to the combined 2022 and 2023 vertical distribution of wave power as controlled by lake level regulation.

Figure 29. This photograph shows the results of two years of wave overwash processes that are coupled to the vegetative response.

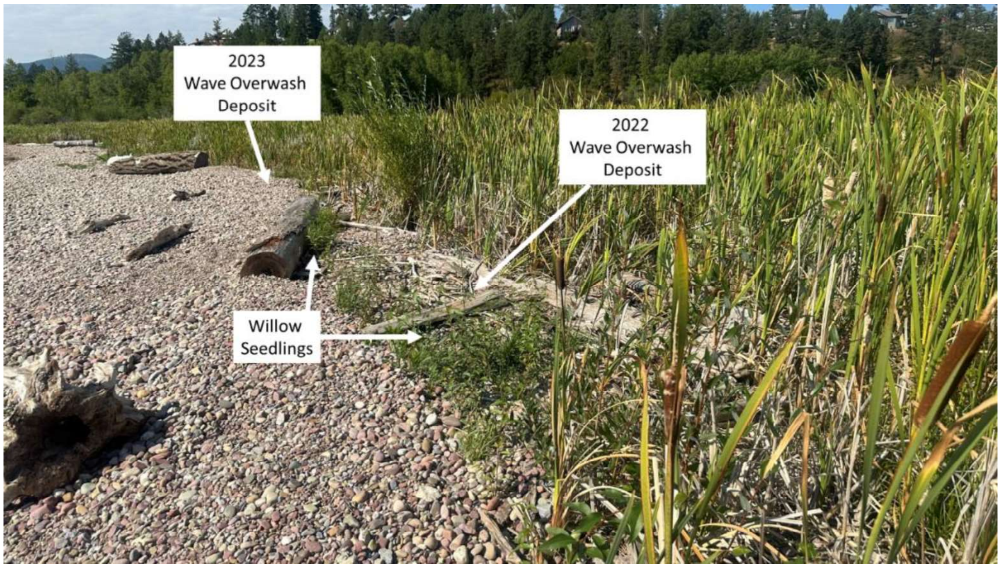


Figure 30. This photograph shows the results of two years of wave overwash processes that are coupled to the vegetative response. The first year overwash events push drift logs against the cattails and deposits gravel. The second-year riparian plants can colonize the new surface layer. This dynamic gravel beach zone is where waves and regulated lake levels coupled with recolonization of wetland and riparian plants work together to form a constantly shifting mosaic of shoreline habitat. These processes maintain an important structural and functional outcome for a healthy nearshore ecosystem in Flathead Lake just as they do in gravel-bed rivers (sensu, Stanford, Lorang and Hauer 2005).

Figure 31. This photograph shows the result of the 2022 lake level and wave overwash processes that are coupled to those wave events and the subsequent vegetative response. Note that at full pool the lake level would reach the position of the person walking the beach. This means that during the high lake level that exceeded 2893' this beach acted as a submerged breaker bar allowing waves to push logs and gravel shoreward into the marsh, a process that was followed by regrowth of wetland plants.

Figure 32. This aerial image from Google Earth (10-3-2023) shows the net regrowth of ~0.7 acres of aquatic and wetland habitat (red polygons) over the past two years (2022 and 2023). That vegetive response is directly related to lake level regulation in 2022 and 2023 and the occurrence of storm waves during that period followed by natural colonization of aquatic and riparian plants.

Foot Survey Inspection and Drone-Based Oblique Photographic Documentation of Beach Processes

This section of the report contains supporting information regarding the conclusions presented. The information source comes from photographs taken by foot surveys spanning as far back as 1998, 2005 airborne imagery, drone-base imagery including the most recent oblique drone imagery that was collected twice this past year 2023. The Oblique drone photos are organized in a GIS as ArcMap overlays so that the shoreline condition can be viewed in its entirety. This imagery record will serve as an imagery baseline for future work should that need arise. Historical photos are included and paired with photographs of current conditions. There are 3 focus areas shown by black boxes along with 5 additional areas of interest shown by red arrows shown in figure 33. These are where the following imagery was taken.

The WPA is a dynamic landscape dominated by a shifting mosaic of habitat that is changing from storm to storm and year to year. This process will continue long into the future especially given the way Energy Keepers Inc. have chosen to operate *SKQ* dam. How that can manifest into a healthy nearshore and wetland landscape is shown in figures 33 through 73. The starting point for appreciating and understanding the positive habitat change on the WPA is apparent when one compares how the barren lakebed in 2005 has evolved into new revegetated land (Figs. 34 & 35).

The remainder of the report is composed of photographs and figure legends that explain and document this positive habitat change without the need for additional discussion text, or data analysis. This documented positive habitat change is crucial outcome for the survival of many different organisms, not just waterfowl. The process shift from shoreline erosion and land loss to dynamic stability and accretion has resulted in ecosystem rejuvenation driven mainly by water level regulation and the placement of gravel material.

Many managers from USFWS and MTFWP and dam operators together had the vision to take a soft structure approach to solving a severe wave erosion problem. We gave the system gravel and let the waves to the work of creating a system of dynamic gravel beaches and associated nearshore habitat critical to the wellbeing of Flathead Lake and those humans and wildlife lucky enough to experience it.

Most important to understand is that the work of this habitat rejuvenation has been accomplished by wave action. We let the waves shift from eroding the land and leaving a barren lakebed (Fig. 36) to doing the work of healing the landscape. That process shift accelerated in 2016 when Energy Keepers took over management of *SKQ* dam. Indeed, this positive change is fundamentally due to how the Energy Keepers operate *SKQ* dam. If lake level regulation were to abandon the fall drawdown (Fig. 16) then we would see a shift back to wave erosion dominance and habitat loss. This shift from wave erosion to habitat restoration is driven by the early drawdown of the lake as demonstrated by *EKI* management of SKQ dam and the water Flathead Lake receives from the watershed.

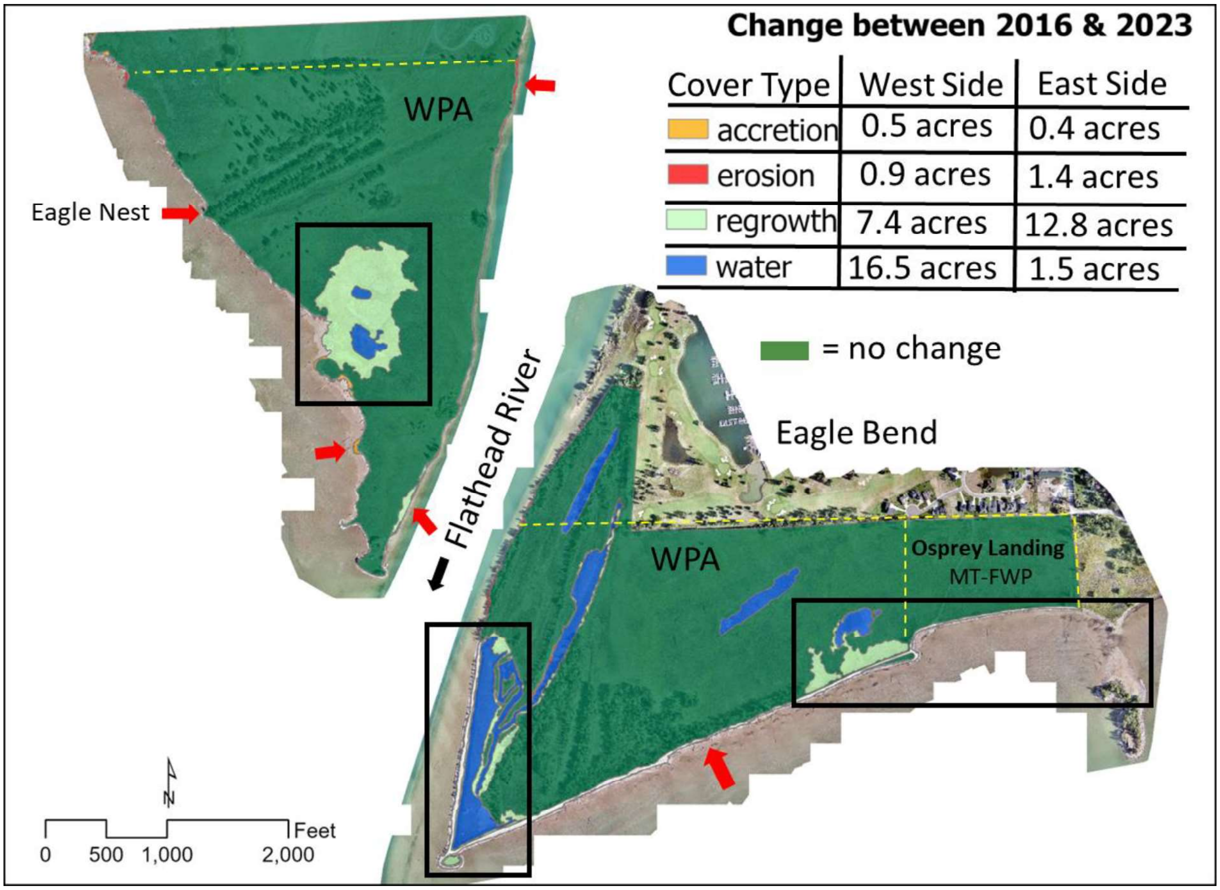


Figure 33. This map is a repeat of figure 5 with slight changes in the black boxes and red arrows pointing the reader's attention to where the following 41 figures are focused. The Yellow Dotted lines show the WPA boundaries and the Osprey Landing area which is owned by Montana Fish Wildlife and Park (MT FWP) but managed in conjunction with the USFWS.

East WPA and MT- FWP Osprey Landing area: (Figure 33, right rectangle)

Figure 34. These four photographs are of the marsh area on the eastern portion of the WPA (far right black box in figure 33). The upper left is a photo of wave overwash process in action taken in 1988. The white arrow points to a Golden willow tree that was growing at the time in this location. It serves as a reference point in the following photos here and in other figures to aid in appreciation of the changes that have occurred. The photo in the upper right is a drone image with each photo icon linked within the ArcGIS database to the oblique images (orange dot). The photo in the lower right corner is the oblique image highlighted in orange dot in the upper right photo. The lower left photo is from the foot survey.

Figure 35. This aerial drone image taken in August 2023 photo shows a revegetated spit embayment and wetland complex behind it. The area in the yellow box looked just like the barren lakebed within the black box prior to construction of the gravel dikes. This photo area is shown as a yellow box in figure 36.

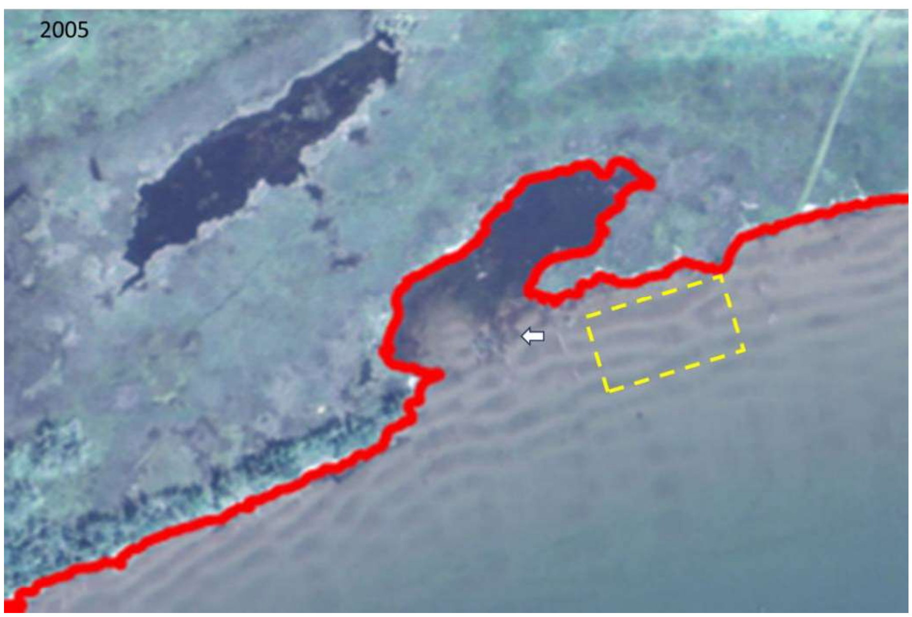


Figure 36. This is a 2005 aerial image of the area in the eastern most black box shown in figure 33. The yellow box shows the area outline for figure 35. The red line is the 2005 shoreline. The pond prior to 2005 was not connected to the lake (Fig. 34 upper left photo). The first breaching of the marsh shoreline occurred in 1988 and widened over the years eventually filling in the pond as shown in this 2005 aerial photograph. The fields of multiple bars play a crucial role in reducing wave erosion. They form due to a standing wave pattern that develops creating rhythmic repeated patterns of sand bars and troughs. Incident waves break on the bar crests and hence dissipate some of the wave energy as spilling breakers. During storms, waves breaking across these bars can extend hundreds of meters offshore. The white arrow shows the position of the golden willow that appears in other figures as a reference.

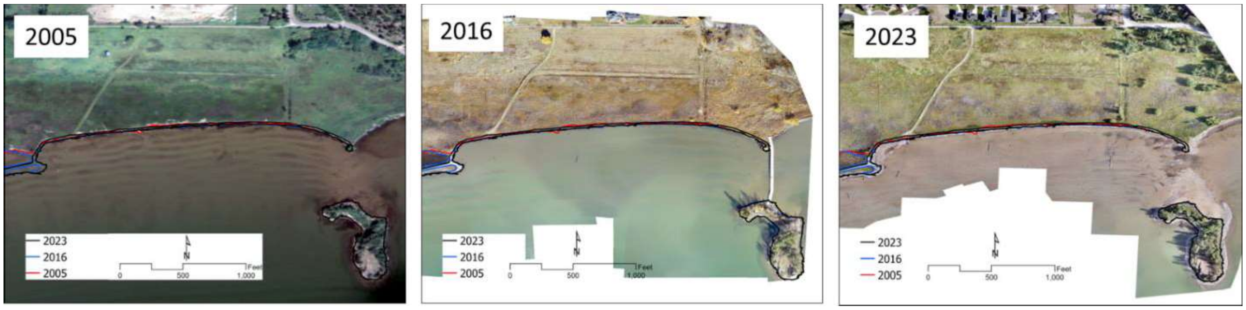


Figure 37. **These three aerial photographs correspond to the right black box in figure 33. The only measurable change at this scale is the construction of and removal of a bridge between the wetland and the offshore island. In 2005 the shoreline was retreating at an average rate of 1 m/yr. due to wave erosion in the form of overwash process. The thickness of the black 2023 shoreline is approximately 1 m. The gravel beach constructed in 2007 has stabilized this shoreline (Figs. 38 & 39).**

Figure 38. **These four photographs show the shoreline from ground level that corresponds to the aerial views in figure 37. The upper left photo shows the condition of the shoreline in 2007 prior to construction of the beach. Overwash process would push the logs further into the marsh while eroding the mud bank/lakebed just lakeward of the logs. The upper right shows the finished gravel beach prior to lake level rise. The lower left shows the deposition of logs and woody debris on the gravel beach after the first full pool season. The photo in the lower right shows the condition of the shoreline in 2016. Fine wood chips and peat material deposited by wave action are mixed with windblown sand to create a perfect growing medium for wetland plants.**

Figure 39. These two photographs compare the shoreline condition from 2016 left panel with 2023 conditions. Larger driftwood has been added and some riparian trees and shrubs have begun to take hold. This gardening process, completed by the waves grinding up the annual supply of logs into woodchips and peat then spreading that material over the gravel beach and into the marsh, is a classic example of the kind of goods and services provided by nature free of charge. The lake level regime between 2016 and 2023 has dramatically helped the gardener resulting in erosion control and shoreline restoration.

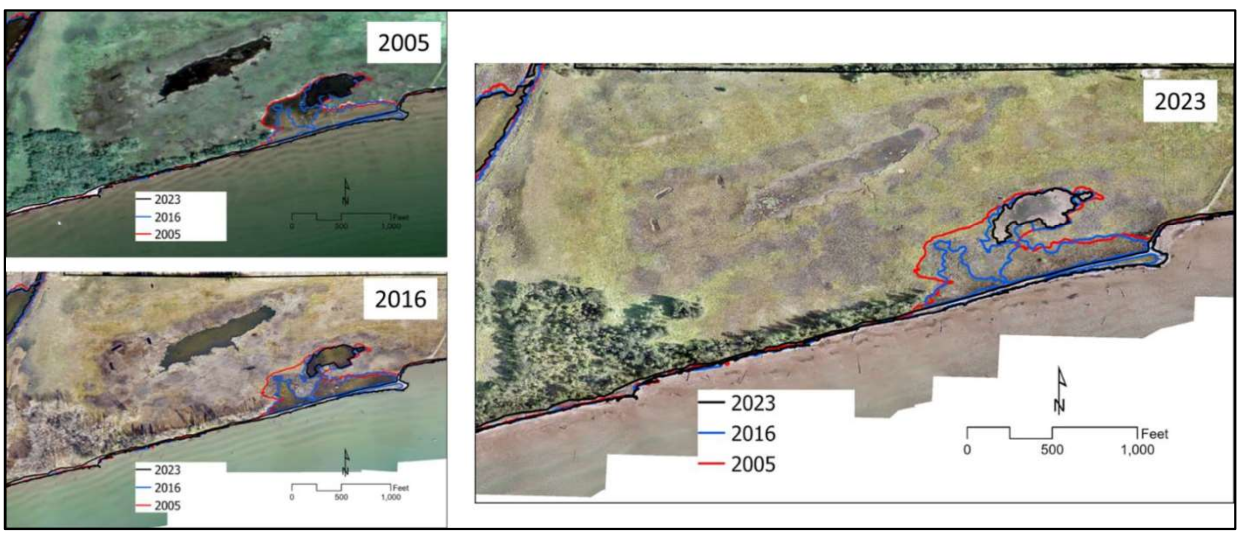


Figure 40. These three aerial photographs show the change of a larger area the includes the ponds within the WPA and the first offshore gravel dike/beach that reclosed the most lakeward pond.

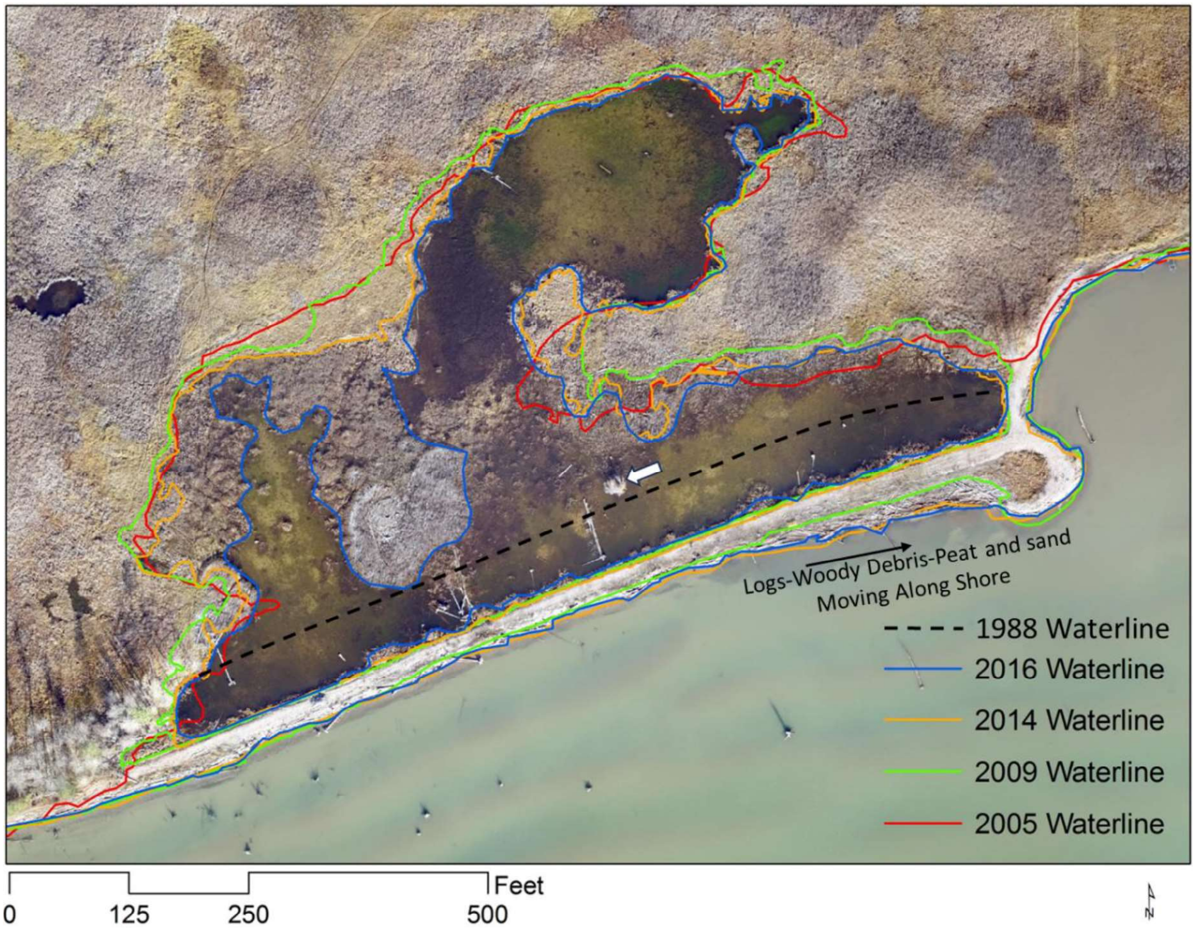


Figure 41. This aerial photograph shows the condition of the lakeward pond and shoreline in 2016. The 2009, 2014 and 2016 shorelines show the progression of shoreline change behind the gravel dike constructed in 2008. The white arrow shows the position of the willow identified in figures above and the black dotted line is the approximate position of the 1998 shoreline. Waves transport wood debris and sand along shore from west to east. The spit was designed to capture this material.

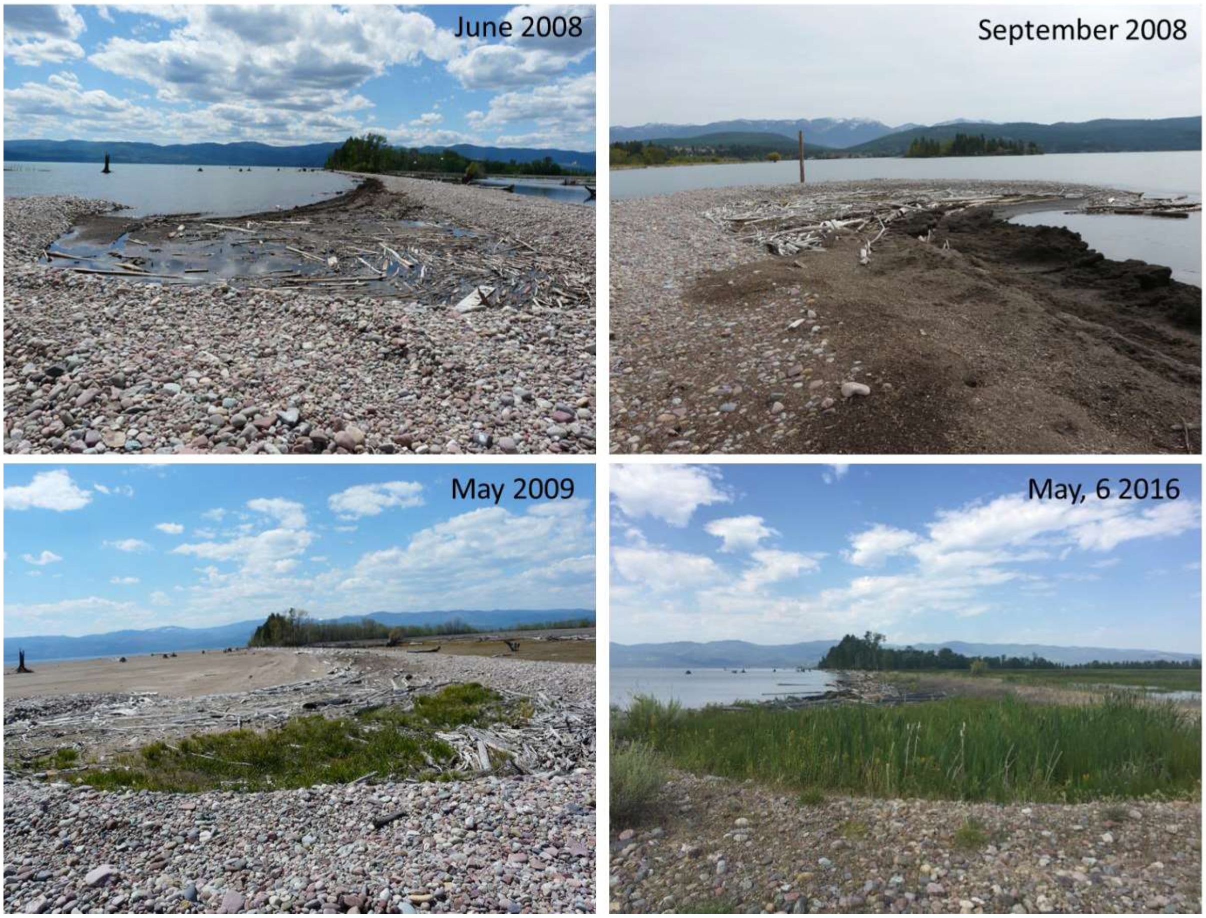


Figure 42. These four photographs show the evolution of the spit embayment from 2008 to 2016. The spit captures wood debris transported along shore by waves completely filling the embayment in the first full pool season.

Figure 43. These two photographs show the change between 2008, the first full pool season after the gravel dikes were built, and 2023. The white arrows show the position of the willow that appears in several figures as a reference point. The pond area behind the dike has been revegetated with aquatic and emergent marsh plants.

Figure 44. These two photographs together with figure 34 show the change between 2008, the first full pool season after the gravel dikes were built, and 2023. The white arrow shows the position of the willow that appears in several figures as a reference point. The growth of willows and cottonwood trees on the inside of the gravel dike has started the reforestation of the gravel dike. This dike was left to revegetate naturally while the offshore dikes near the river mouth were replanted over most of the dike along the river arm and the spit. This dike would have a more diverse and mature forest had it been replanted with riparian trees and shrubs. Wind blown sand that deposits on top of the gravel helps the natural revegetation process. Foot traffic keeps a path open (Figs, 43 and 44)

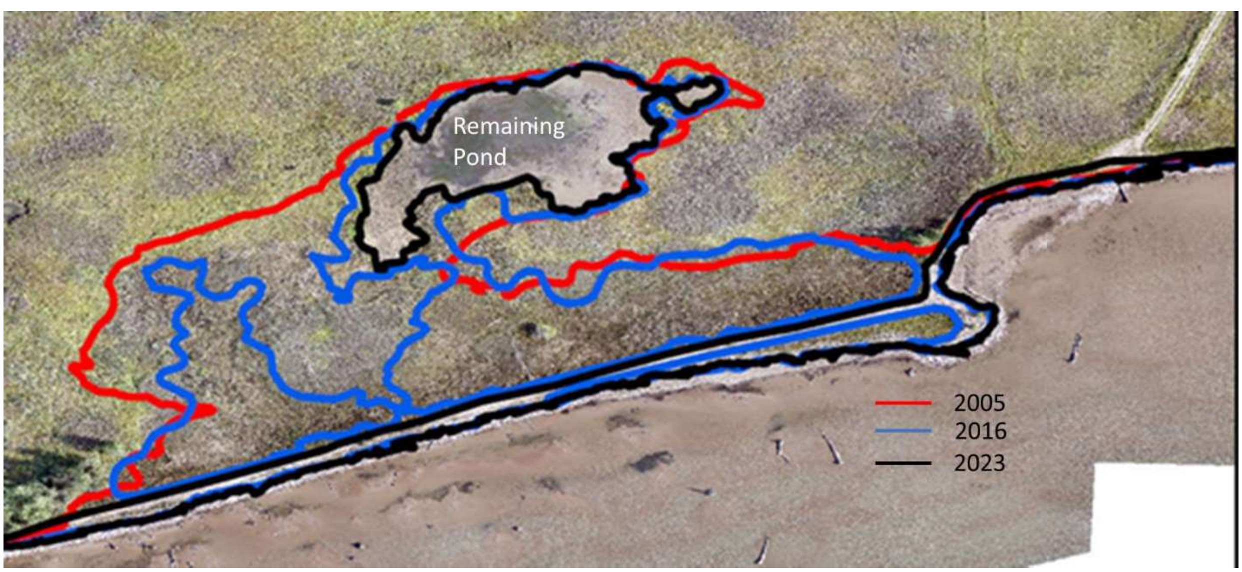


Figure 45. A closeup view of the 2023 condition for the shoreline and pond area is shown.

Figure 46. **A ground view of the 2023 condition of the lakeward shoreline at the mouth of the spit embayment. Now that the embayment has filled, large wood and peat material bypass the spit on their trek eastward.**

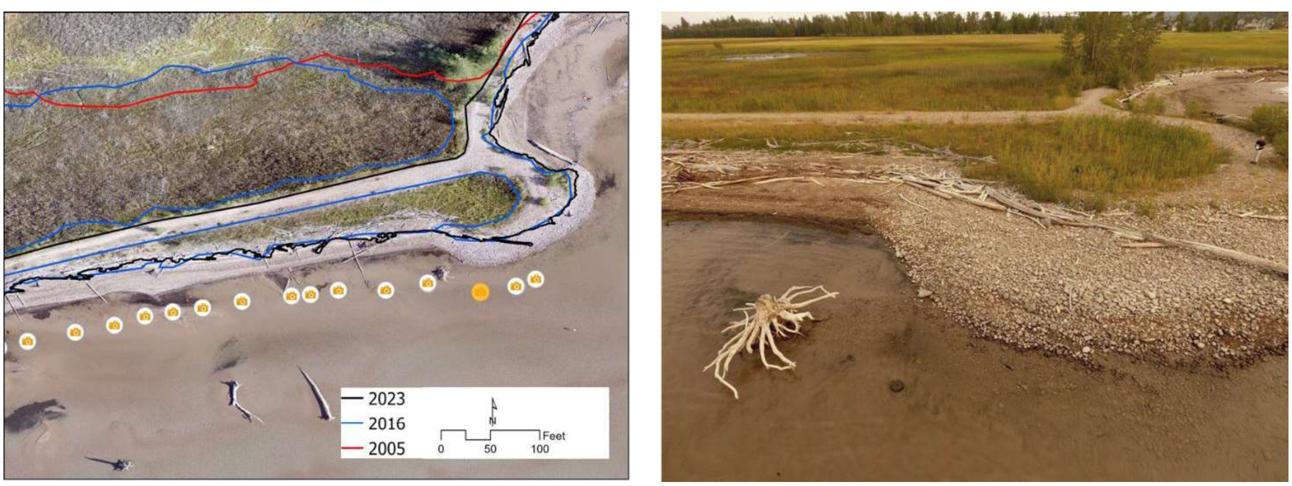


Figure 47. **The left panel is a 2023 aerial photograph of the spit with the orange dot indicating the location of the oblique aerial photograph (right panel) of the same area shown in figure 45.**

Figure 48. This is a photograph looking south at the gravel beach that connects to the spit. Note the mix of logs-sand and regrowth of riparian shrubs and trees along a specific line and elevation. That elevation is the full pool lake level of 2893 ft.

Lakeward Shoreline East WPA: (Red Arrow east side in Figure 32)

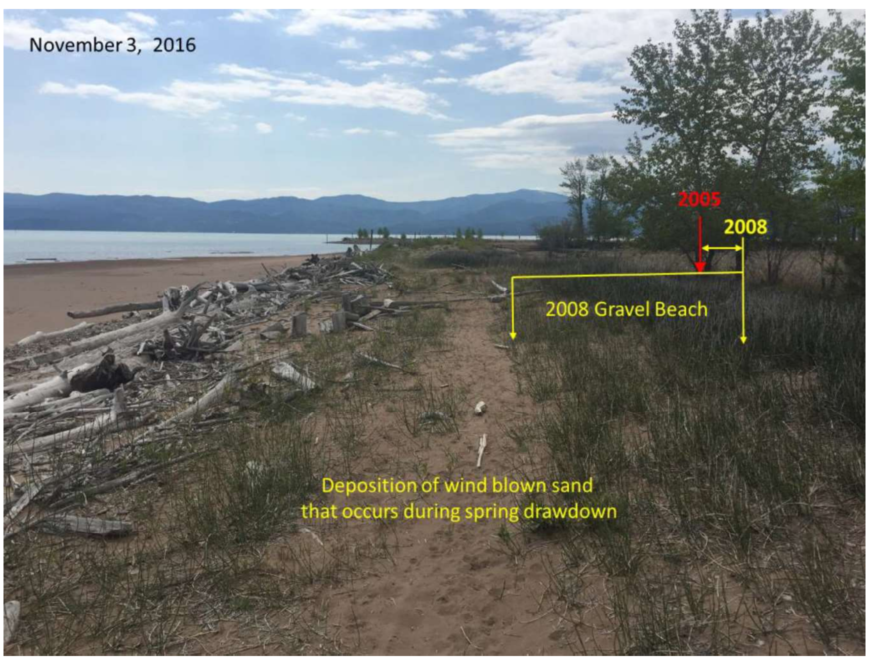


Figure 49. This is a 2016 photograph showing the condition of the shoreline in this area. The deposition of windblown sand and logs followed by riparian succession of plants results in the creation of new, dynamic shoreline habitat. Here the gravel beach is completely buried.

Figure 50. These four photographs show the current 2023 condition of the shoreline on the lakeward side of the eastern WPA. This section of shoreline has been accreting since construction of the shore attached gravel beach in 2008. The deposition of windblown sand and logs followed by riparian succession of plants results in the creation of new, dynamic shoreline habitat. The red dotted lines show the approximate position of the 2005 shoreline.

River Mouth Offshore Gravel Dike: (black rectangle right side in Figure 33)

The gravel spit at the eastern side of the river mouth is shown below (Figure 2 from 2017 report). Photos from similar locations are included in this 2023 report that refer to pilings A- G (Figs. 51-65). Wind data was collected at the weather station located at piling C (see photo inset).

Figure 2. This graphic, from the 2017 final report is a color enhanced, 3D oblique aerial view of the offshore beach and spit just east of the river mouth. This DEM was derived from drone-based LiDAR data and imagery collected May 5th, 2017. The water appears black and the exposed lakebed tan to light brown. The location of pilings driven into the lakebed are shown with labels near those where cross-sectional profiles are compared between May and Oct LiDAR data collections. Location of photographs are shown by corresponding Fig. # with black arrows showing the view orientation. The red dotted lines with arrows show the direction of gravel transport. The photo inset shows the weather station located at piling C.

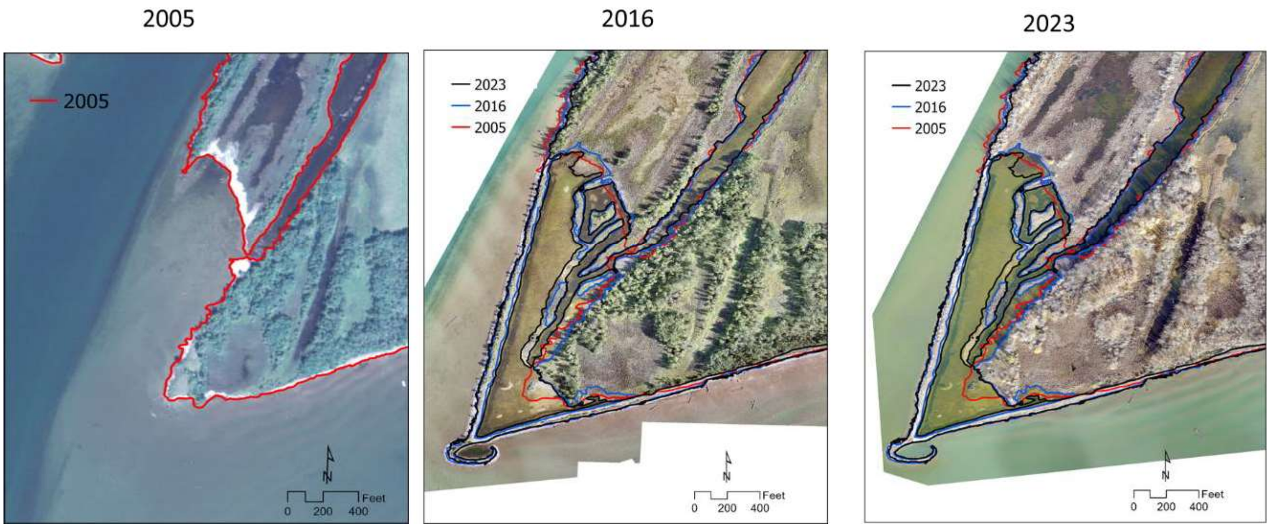


Figure 51. **These three aerial photographs show the change in the east side river mouth since 2005 and after the construction of the offshore structures which began in 2009 and were completed in 2012.**

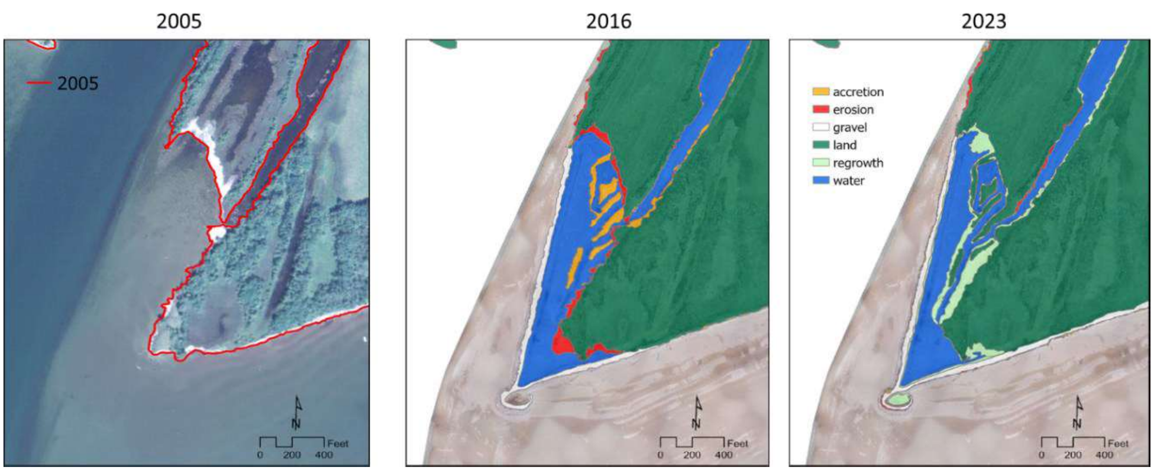


Figure 52. **These three aerial photographs show the change in the east side river mouth since 2005 and after the construction of the offshore structures which began in 2009 and were completed in 2012. The red areas of erosion shown in 2016 occurred between 2005 and 2009 prior to constructing the gravel dikes. The orange accretion areas in 2016 are those features that were created with an excavator during construction of the dikes between 2009 and 2012. Those areas were created by piling excavated lakebed material on top of large driftwood and other woody debris. These areas have continued to provide substrate for the natural revegetation of riparian shrubs and trees like the natural riverbank levees. However, not much new regrowth of aquatic and riparian habitat has occurred behind the offshore gravel dikes as most of the acreage behind the dikes remains open water. This is partly because the waves eroded this area down to a clay layer in the lakebed and that the water behind the dikes is stagnant and gets very warm. More growth and habitat would evolve if the cobble plugs were removed allowing the river to flow through these backwaters as originally designed (see figures 13 & 14).**

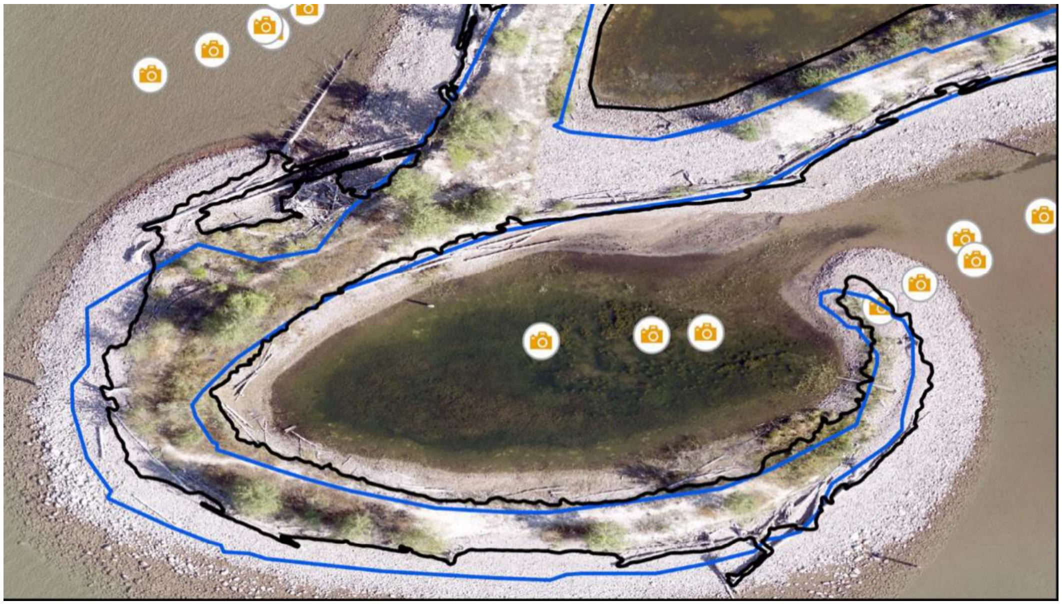


Figure 53. This aerial photograph of the spit embayment shows the extensive regrowth of aquatic plants within the spit embayment. It also shows the areas of erosion and deposition since 2016 on the outer lakeward shoreline (difference between blue 2016 and black 2023 shorelines). The gravel beaches in this area are exposed to the highest levels wave action for the entire WPA constructed shoreline.

Figure 54. These three aerial photographs show the condition of the lakeward 2023 shoreline on the gravel spit. Piling F is visible in the lower right photo. The left photo is near piling B. Red arrows show photo view orientations.

Figure 55. These four ground-based photos compare the change in shoreline condition for the offshore gravel dike and lakeward beaches between 2016 and 2023. The red arrow points to the deposition of aquatic plants by wave action. Although the vertical bank leads one to assume that this area is eroding the actual measured change in shoreline position does not support that assumption. This shoreline is in a state of dynamic equilibrium where waves move and shift the supply of logs and the available gravel creating a shifting habitat mosaic. Leave it alone and if a surface breach occurs here that would be a good thing because it would allow better exchange of water between the lake and the ponds behind the gravel dikes. Piling A can be seen in the top photos.

Figure 56. This photograph shows the condition in 2023 of the inside shorelines of the gravel banks. They are very similar to the natural levee banks in this area of the north shore.

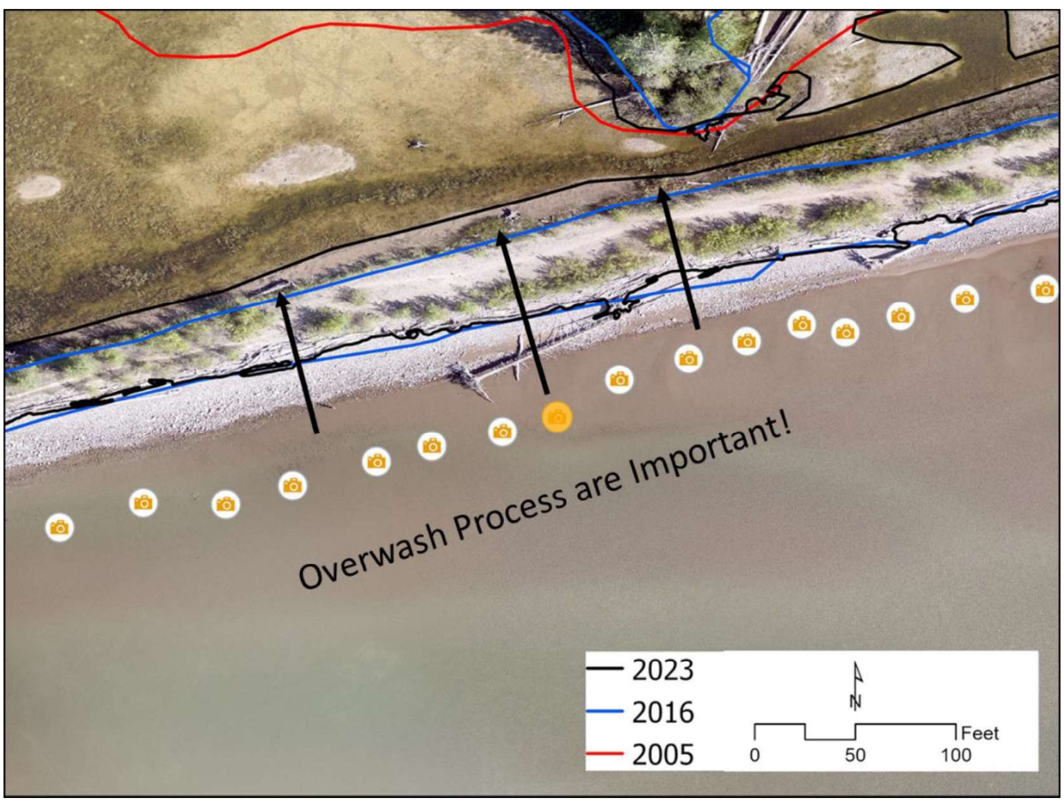


Figure 57. Overwash continues along the offshore dike. This process results in large wood and other woody debris being carried over the dike and deposited on the backside which adds to the shoreline complexity along that side of the dike.

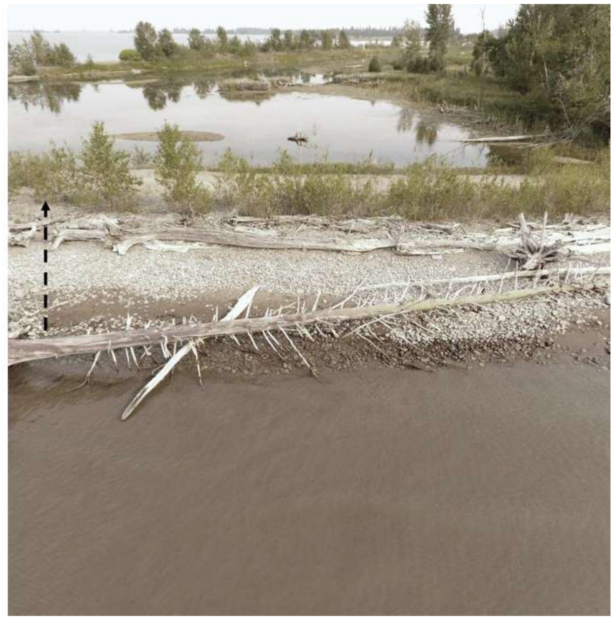


Figure 58. These are oblique drone images between Pilings F and G. The left photo is during lake draw down 2023 and the right photo from same area in August 2023. The black dotted arrows show flow paths from wave overwash.

Figure 59. These two photographs show the 2023 shoreline condition of the offshore dike looking east from the spit. The southern wave side maintains a dynamic beach whose job is to extract and absorb all the wave energy (right photo piling G) while the northern pond side is calm enough to allow riparian trees and shrubs revegetate the dike (left photo). Piling G can be seen in both photos. The pilings correspond to transect lines where survey data was extracted from the DEM, and DSM's.

July 2016 August 2023

Figure 60. These two photographs compare the shoreline condition of 2016 (left photo) with that of 2023 (right photo) near transect F.

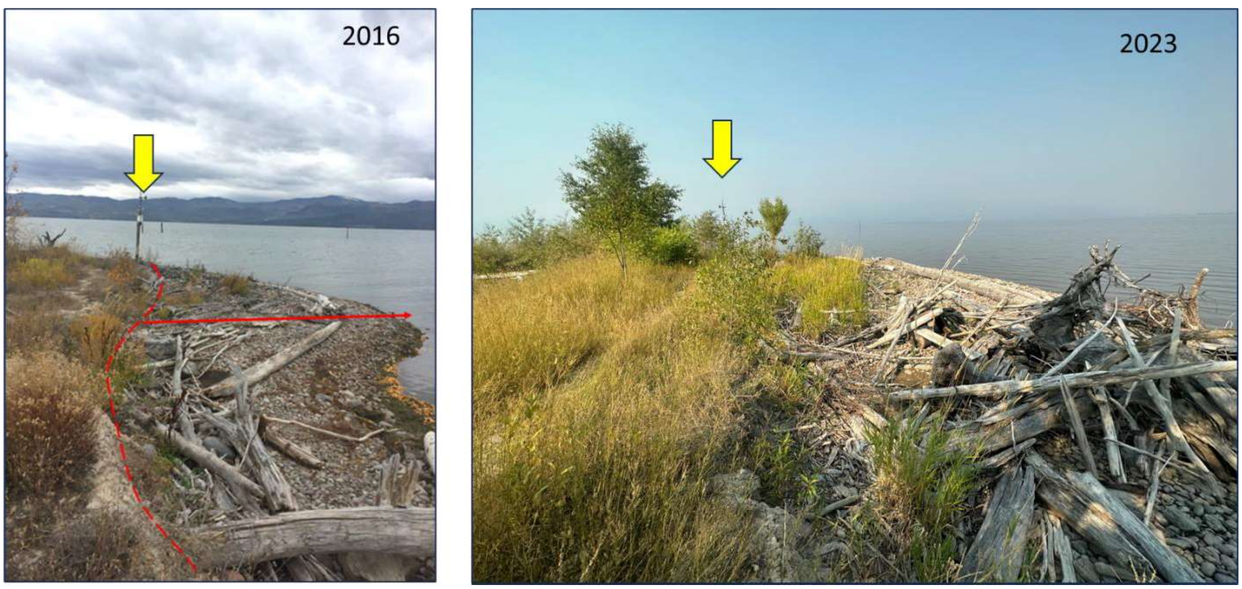


Figure 61. These two photographs compare the shoreline condition of 2016 (left photo) with that of 2023 (right photo) near transect C. Yellow arrow points to the weather station where the wind data for this report is gathered.

Figure 62. These two photographs compare the shoreline condition of 2016 (left photo) with that of 2023 (right photo) near transect G.

Figure 63. These two photographs compare the shoreline condition of 2016 (left photo) with that of 2023 (right photo) near transects F and G.

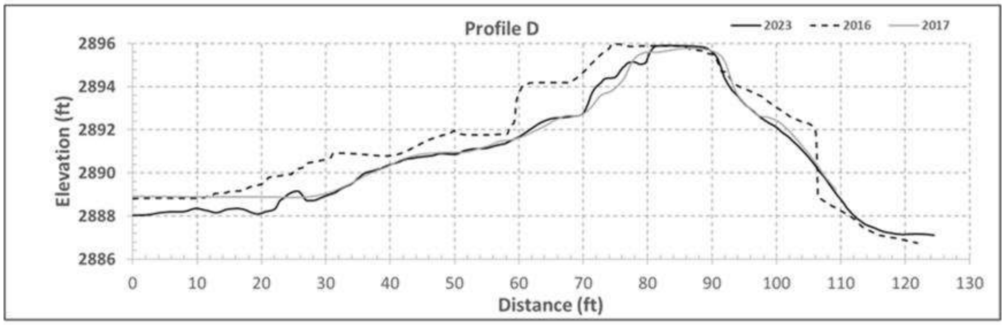


Figure 64. This photograph shows the 2023 condition of the shoreline near piling D where the transect data from that location are plotted above (top panel). There has been erosion of the very top layer of lakebed material that was used as a cap on the dikes. Note that the eroded bank is at an elevation of 2894 ft. This means that only swash from storm waves can reach this elevation and erode the bank. Waves could possibly breach through the top layer and maybe even scour to 2893 or 2892 creating a full-pool breach and second connection with the lake and the spit embayment. That would be great! The more flushing the embayment receives the better. As of right now there is only one opening to the embayment.

Figure 65. This photograph shows the condition of the 2023 backshore of the gravel dike and spit embayment. The white arrow shows figure 64 view where a break could happen as described in the figure 64 legend.

West Side (black rectangle left side Including two red arrows Figure 33)

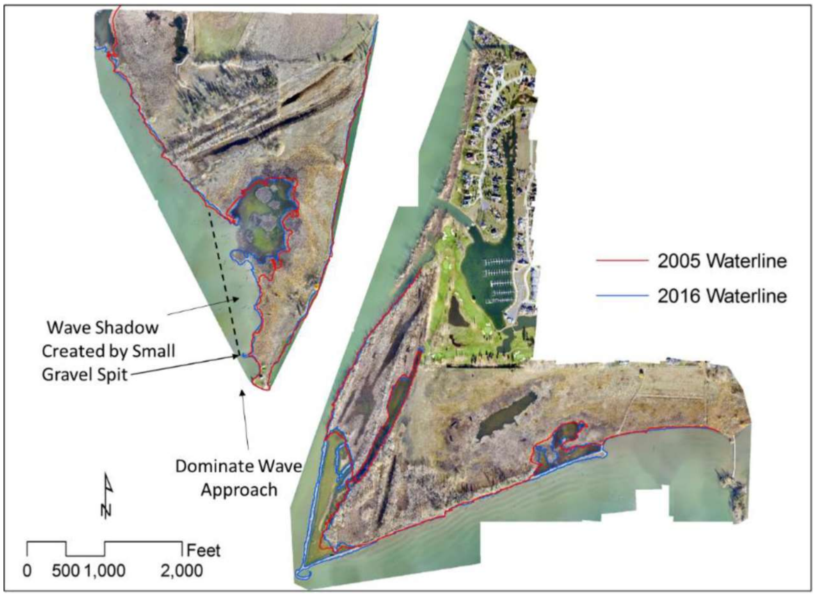


Figure 66. This is a repeat of figure 2 placed here to add context to figure 67 allowing the reader to see both figures. The important feature is the small spit formed to create a wave shadow of protection from waves formed in the main body of the lake. This shoreline receives thermally driven wave action from the west during full pool season. The combination of the spit and wave climate set the stage for regrowth of vegetation.

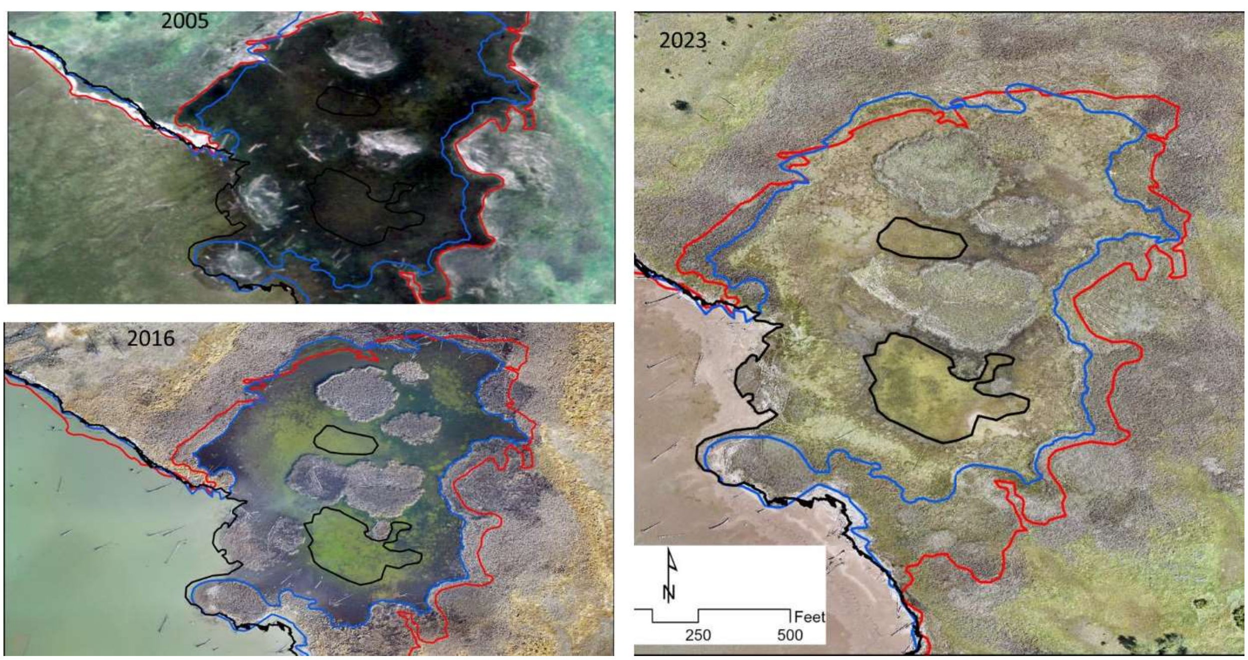


Figure 67. These three panel maps show the evolution of the embayment and shoreline over time.

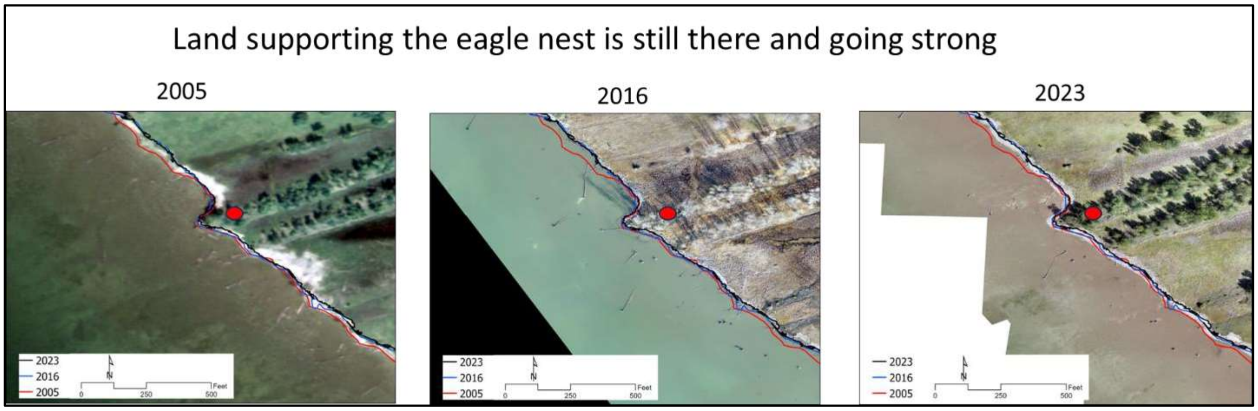


Figure 68. These two panel maps show the stability of the shoreline over time around concern regarding the eagle nest (red dot) in this area.

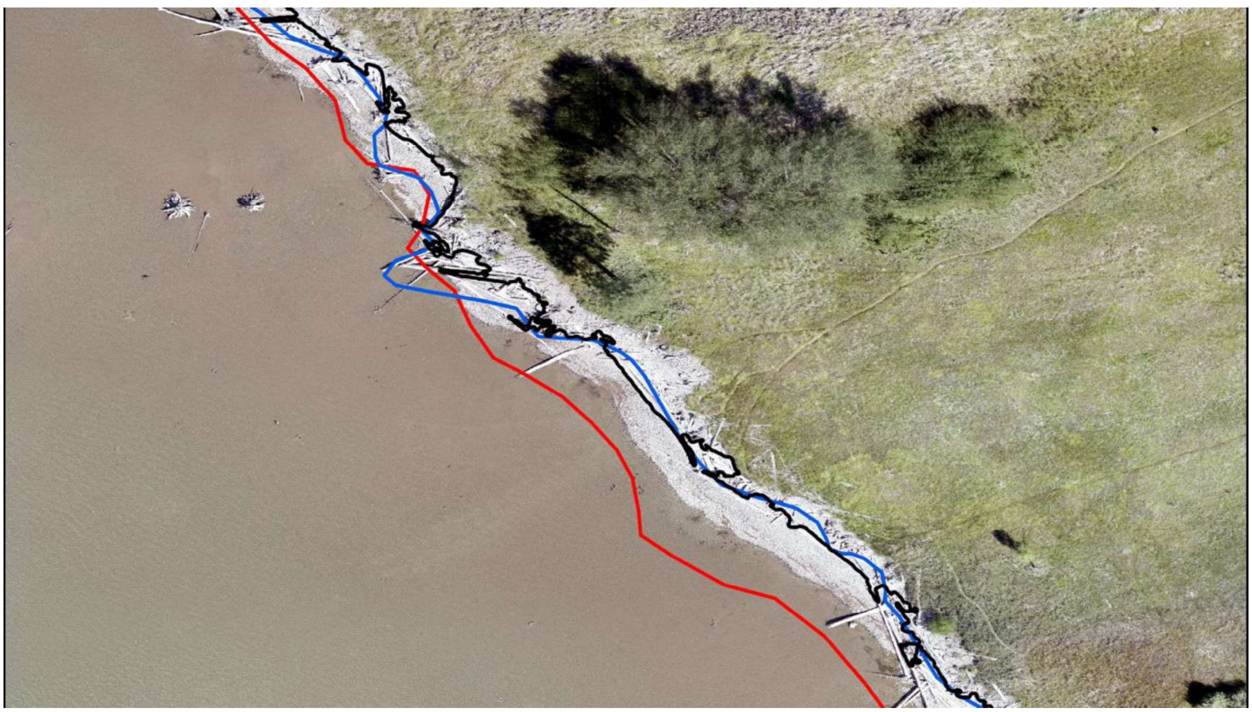


Figure 69. This 2023 drone-based aerial photograph shows shoreline variability between erosion and accretion.

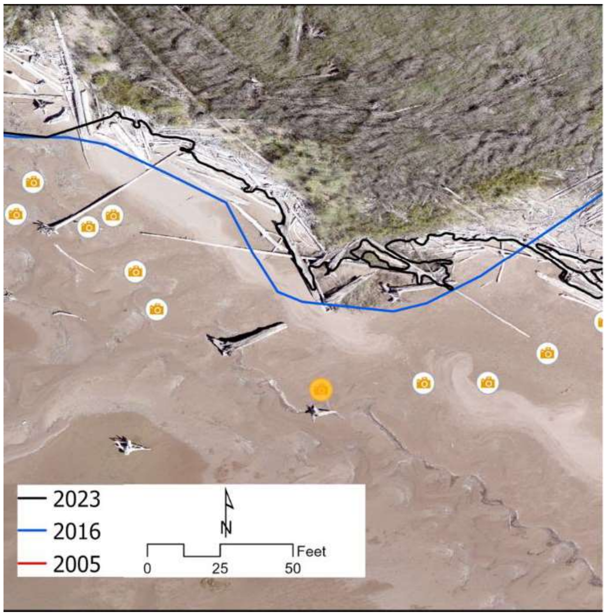


Figure 70. These two panel maps show the location of an oblique aerial photo (left image) and the oblique photo (right). Note the formations of sand spit morphologies in both photographs and the role of logs disrupting wave action to allow the regrowth of wetland vegetation including willows.

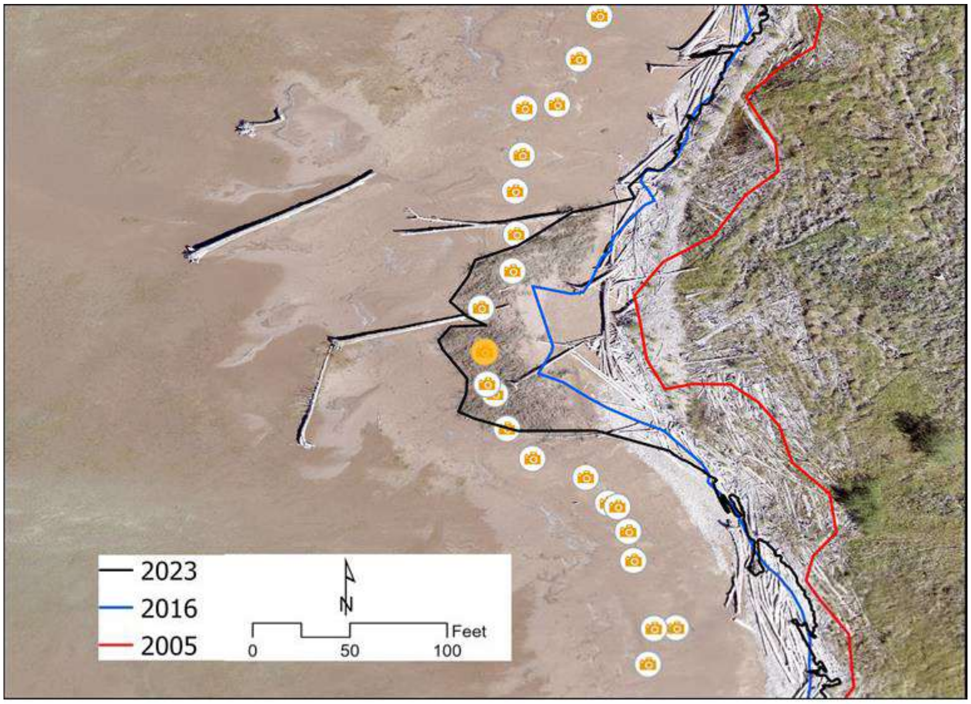


Figure 71. These two panel maps show similar behavior as displayed in figure 70. Landscape evolution in both is a function of lake level regulation, wave climate and the wave shadowing of the gravel spit coupled with sand transport including large driftwood and regrowth of vegetation.

Riverbanks (two red arrows Figure 33)

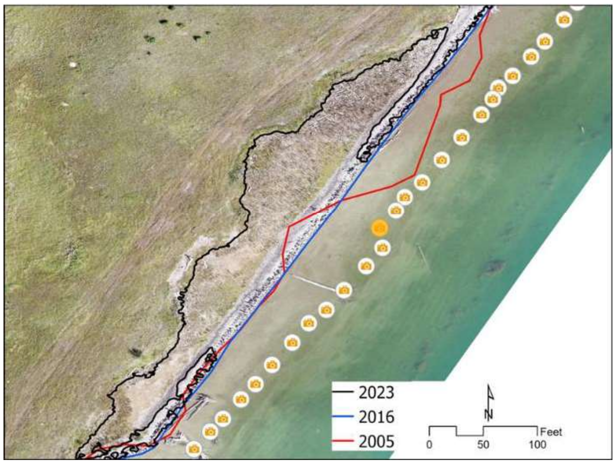
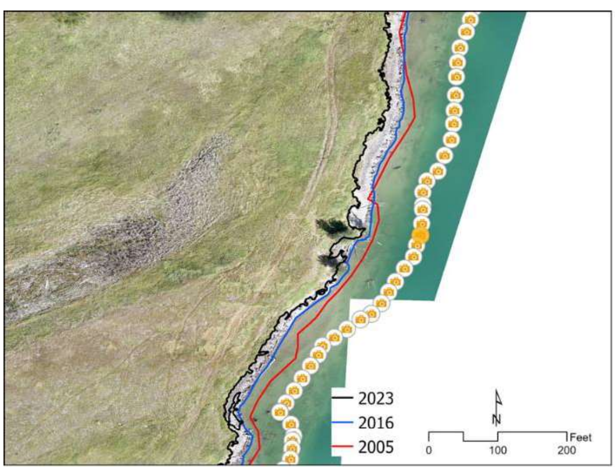


Figure 73. The aerial photograph on the left shows the riverbank condition on the west side. The logs and root wads are adjusting and settling into the gravel matrix as a function of wind-waves, boat wakes and river currents. The Oblique photograph on the right shows the gravel, log, root wads that absorb waver energy and river currents. The approximate location of the 2005 shoreline is shown. This would be a good location to plant native riparian trees and shrubs along the trend of the 2005 shoreline.



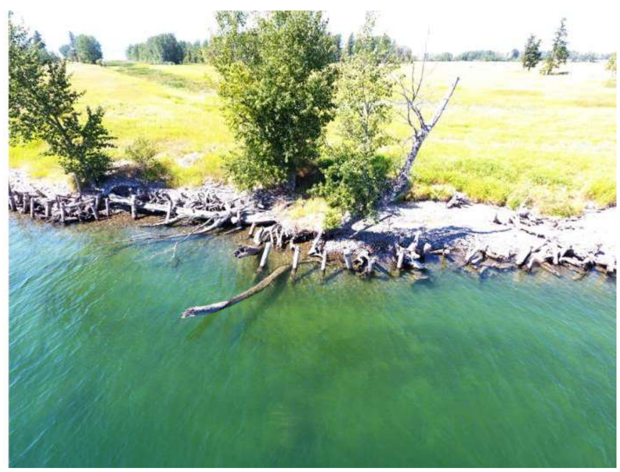


Figure 74. The aerial photograph on the left shows the riverbank condition on the west side near the northern WPA boundary. The logs and root wads are adjusting and settling into the gravel matrix as a function of wind-waves, boat wakes and river currents. The Oblique photograph on the right shows the gravel, log, root wads that absorb waver energy and river currents. The approximate location of the 2005 shoreline is the line formed between the gravel and the grass. This would be a good location to plant native riparian trees and shrubs.

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CERTIFICATE OF SERVICE

I hereby certify that I have this day caused to be served the foregoing document upon each person designated on the official service list compiled by the Secretary in the above-captioned proceeding.

Dated at Washington, DC this 5th day of February, 2024.

/s/ *Mealear Tauch*
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