# MERRIMAC FERRY PERFORMANCE & RELIABILITY IMPROVEMENT STUDY

**Phase 1**

November 2024

Prepared by KPFF Consulting Engineers and Elliott Bay Design Group

WISCONSIN DEPARTMENT OF TRANSPORTATION

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# Executive Summary

The historic Merrimac Ferry, owned and operated by Wisconsin DOT (WisDOT), has crossed Lake Wisconsin between Okee and Merrimac since 1844. The free crossing carries pedestrians, cyclists, and light- and medium-weight vehicles, connecting Columbia and Sauk counties and serving as a key link of Wisconsin Highway 113, the Ice Age National Scenic Trail, and U.S. Bike Route 30. The 15-car cable ferry operates 24 hours a day and makes trips based on demand. The ferry is typically open between the months of April and December and makes approximately 39,000 one-way crossings annually, carrying an average of over 220,000 total vehicles, 3,000 bikes and 11,000 passengers.

The first phase of the *Merrimac Ferry Performance and Reliability Study* (Study) was undertaken to identify pathways to improve **service reliability** and provide **long-term, sustainable ferry operations** that will support the economic and transportation needs of the region. The study also aimed to identify ways to **reduce the greenhouse gas emissions** of the current ferry while continuing to **support residents, regional tourism, and local businesses**.

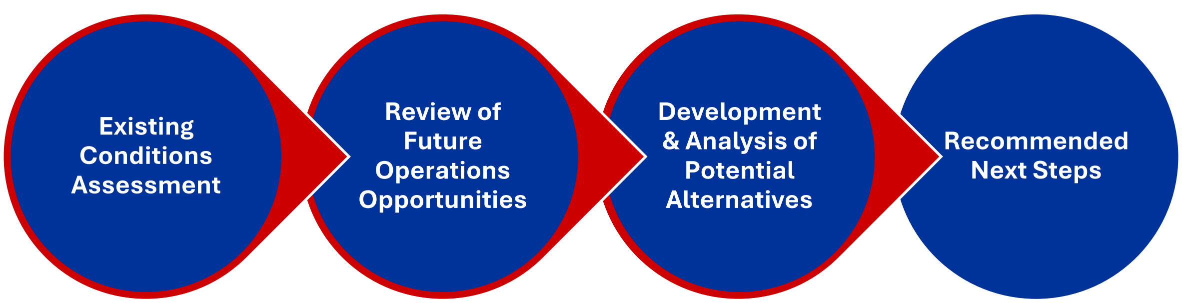
### Challenges of the Current Vessel

- Increasing maintenance requirements and vessel out of service time
- Difficulty procuring and repairing obsolete vessel parts
- Environmental impacts resulting from diesel power

Built in 2003, the current ferry vessel, the *Colsac III,* is aging and is experiencing increasing maintenance requirements and challenges with procuring and repairing obsolete systems. These challenges result in increased operating costs as well as more unplanned time out of service. This Study identified and assessed potential future improvements and vessel alternatives that could meet operational requirements, sustainability goals, and reliability targets for the service.

## Study Approach

The Study consisted of the steps outlined below.



## Short-Term Recommendations

A vessel inspection completed as part of the Study revealed that the current hull and structure of the *Colsac III* are in excellent condition and could continue operation for roughly 25 years with proper maintenance. However, the inspection also identified three key concerns for the existing ferry vessel, identified below along with recommended short-term improvements:

- **Cable wash**- The addition of a cable wash system where the cable enters the vessel may reduce the collection of grit that is causing the cable to fail.
- **Hydraulic system**- Replacement of the current flexible hydraulic hose with ferrous piping, such as carbon steel or stainless steel, to provide better protection against fire and a rigid conduit for hydraulic oil.
- **Fire suppression system**- Updates to the current system to ensure it can operate successfully in the event of a fire.

## Long-Term Recommendations

To address the future needs of the Merrimac Ferry crossing, either a major refurbishment of the existing vessel or construction of a new vessel will be required within the next 2 to 5 years as the *Colsac III* approaches the need for a major systems overhaul. Following an existing conditions assessment and operational review, five potential vessel improvement and replacement alternatives were identified as viable for the Merrimac Ferry. These included:

**RETROFIT THE *COLSAC III***

1. Vessel Repower – New Diesel Engine
2. Propulsion System Replacement – Hybrid Diesel-Electric
3. Propulsion System Replacement– All Electric

**NEW VESSEL**

4. New Hybrid Diesel-Electric Vessel
5. New All-Electric Vessel

All five potential alternatives were recommended for further scope development and review in future project phases.

### Shoreside Improvements

For Vessel Alternatives 3 and 5, shoreside improvements would be required to support electric charging of the new vessel, which would necessitate shoreside electrical improvements and installation of charging infrastructure. Preliminary coordination with Alliant Energy, the local energy provider for both ferry landings, identified the northern ferry landing at Merrimac as most promising for installation of charging infrastructure.

## Next Steps

Future project phases will build upon the findings and recommendations from this Study. Recommended next steps include the following.

**Preliminary Design of Alternatives.** Potential vessel alternatives and associated shoreside improvements will be advanced to a preliminary design level to inform assessment and comparison of alternatives, including both short- and long-term project effects. Preliminary design will provide project information to support more detailed analysis and project planning.

**Public and Stakeholder Engagement.** WisDOT will begin public and stakeholder engagement to provide project updates and gather feedback on proposed alternatives.

**Agency Coordination and Environmental Review.** WisDOT will begin engaging with key agencies including, but not limited to, the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, Wisconsin State Department of Natural Resources, Columbia and Sauk County, and the Wisconsin Historical Society. Preliminary coordination with agencies will help identify the likely class of action for environmental review and permitting requirements for the project.

**Utilities Coordination.** Continued coordination with the local utility, Alliant Energy, is vital to understanding the infrastructure needs and potential costs of vessel alternatives that incorporate shoreside electric charging. Alliant Energy will be a key partner in coordinating the project with near- and long-term local energy improvements, as well as pursuit of funding opportunities for project alternatives that include an emissions reduction component.

**Exploration of Funding Opportunities.** As estimated project costs are refined in the next project phase, WisDOT can begin development of a funding plan to meet anticipated capital cost needs. Next steps will include exploration of grant funding opportunities and early planning and coordination to support grant applications.

# Introduction

The Wisconsin Department of Transportation (WisDOT) operates the Merrimac Ferry which links Wisconsin Highway 113 between Okee and Merrimac across Lake Wisconsin. The current vessel, the *Colsac III*, is facing increasing reliability challenges and maintenance requirements. WisDOT undertook this first phase of the *Merrimac Ferry Performance and Reliability Improvement Study* (Study) to develop alternative concepts that improve service reliability, reduce vessel emissions, and meet the needs for all modes of travel for both the short- and long-term future of this ferry service. The Study included the following tasks:

- Existing conditions assessment, including review of current and historical operations and service data, assessment of maintenance procedures, and inspection of the *Colsac III* and both ferry landings
- Review of future operations opportunities, including benchmarking the Merrimac crossing against similar cable ferry operations
- Identification and analysis of short- and long-term design solutions for future ferry improvements
- Recommendation of next steps, including potential alternatives to be carried forward to preliminary design, anticipated environmental review requirements, and identification of potential funding opportunities

This report documents the key methodology and findings of the Study.

## Project Purpose and Need

The Merrimac Ferry crossing currently provides an important cross-county highway connection as part of Wisconsin Highway 113, a major collector, connecting to the minor arterial State Road 78 on the Sauk County side of the route. Along with serving as a link on Wisconsin Highway 113, the route is a connecting link of the 1,000-mile Ice Age National Scenic trail, one of the 11 designated national scenic trails in the United States. The ferry crossing connects two of the Ice Age Trail alliance communities, Baraboo and Lodi. The also crossing supports community and transit access between three designated State Natural Areas/Parks: Devil's Lake State Park, Palfrey's Glen, and Gibraltar's Rock.

The crossing itself is historically significant, having been in service since 1844. Added to the historic register in 1975, its continued operation connects residents and visitors to the area's past and serves to maintain the historic character of the region.

A regionally significant crossing, the Merrimac Ferry crossing is:

- An important cross-county highway connection
- A link in the Ice Age National Scenic Trail for pedestrians and cyclists
- A historic connection that has been operating since 1844

## Project Goals

The purpose of this Study is to assess potential future vessel improvement and replacement alternatives that meet the operational requirements of the Merrimac Ferry crossing and that meet the following project goals:

- Provide long-term, sustainable ferry operations to support the economic and transportation needs of the region
- Improve service reliability by reducing maintenance downtime
- Reduce vessel emissions
- Support tourism and local businesses
- Support bicycle and pedestrian access
- Ensure a sustainable future for this regionally and historically significant crossing

***Figure 1: Colsac III***

The findings of this Study will inform future project phases, with the ultimate goal of selecting and implementing a preferred alternative that supports dependable and efficient Merrimac Ferry service for the next 30 plus years.

## Current Challenges

The need for this project arises from challenges with the current vessel including **increasing maintenance requirements** and **associated vessel out of service time**, as shown in **Figure 2** along with difficulty in procuring and repairing obsolete vessel parts. Other challenges include the greenhouse gas emissions produced by the current ferry's diesel engines.

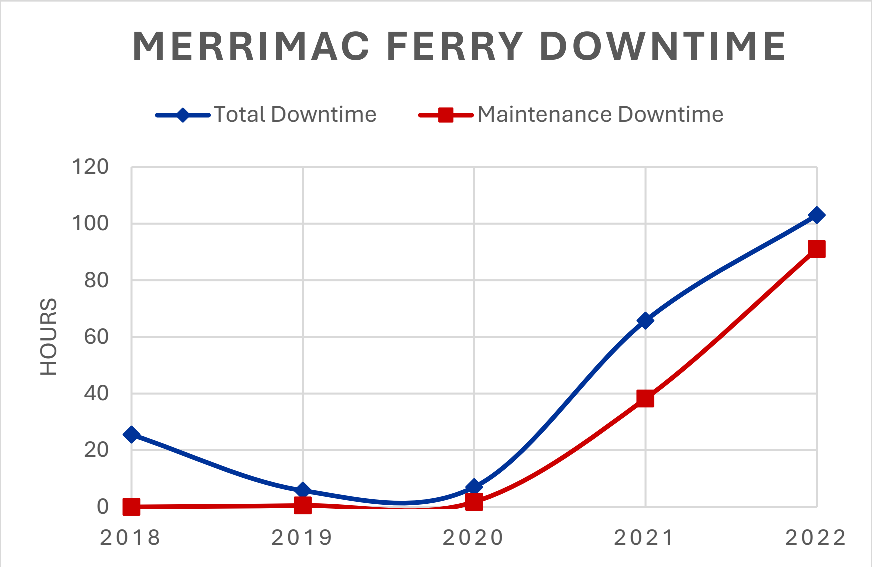



***Figure 2: Merrimac Ferry Downtime 2018 to 2022***

As the vessel continues to age, procurement challenges are anticipated to grow, particularly for brake drive motors, hydraulic manifolds, and cable sheaves. Already long lead times needed for procurement will likely continue to increase due to lower levels of parts in circulation, resulting in increasing operating costs and maintenance staff time requirements. A vessel improvement project is needed to ensure the long-term operation of the ferry crossing.

More information on this project's purpose and need can be found in Appendix A.

## Study Approach

The approach for Phase I of this Study consisted of the four key steps summarized below.

### 1. Existing Conditions and Operations Assessment

Assessment consisted of the following tasks:

- Review of ridership, service level, cost, fuel usage, and maintenance data provided by WisDOT
- Review of current operating and maintenance practices
- On-site conditions assessment of Merrimac Ferry assets including the vessel and landing sites

### 2. Review of Future Operations Opportunities

To provide context for understanding the opportunities and challenges of the current county-based operations and maintenance service model, the following information was reviewed:

- Overview of ferry service provider models and key opportunities and challenges for agencies
- Summary of current Merrimac Ferry operations and assessment of historical operating costs
- Comparison to similar North American cable ferry operations, service levels, and operating costs

### 3. Alternatives Development & Analysis

Based upon the operating and service requirements for Merrimac Ferry service, as well as assessment of feasible retrofit options for the existing hull, five potentially viable future vessels alternatives were identified. Each alternative identified a propulsion and superstructure option, and operational changes needed to support new technologies were identified if necessary.

Alternatives were assessed based on criteria including reliability and ease of maintenance, service level and operating impacts, energy requirements, and estimated capital and operating costs.

### 4. Recommended Next Steps

Following alternatives analysis, recommendations were developed for next steps, including alternatives to be carried forward to preliminary design, future environmental review requirements, and potential funding opportunities.

# Existing Conditions

The following sections provide a summary of key findings from the review of existing conditions of the Merrimac Ferry service. Additional detail is provided in Appendix B, including service and ridership data review, summary of operations and maintenance practices, vessel emissions evaluation, and findings from vessel and terminal conditions assessments.

## Service Summary

The Merrimac Ferry traverses Lake Wisconsin between Columbia and Sauk Counties, linking Wisconsin Highway 113 between Okee and Merrimac, as shown in **Figure 3.** The ferry transports vehicles, pedestrians, motorcycles, and bicycles on the approximately four-minute, half-mile crossing. The ferry has operated as a free crossing since the state took over operations of the service in 1933.

The ferry crossing travels between landings in the Village of Merrimac, Sauk County, to the north, and in Okee, Columbia County to the south. The landings are located more or less in the same places as they were in 1844 when service began.

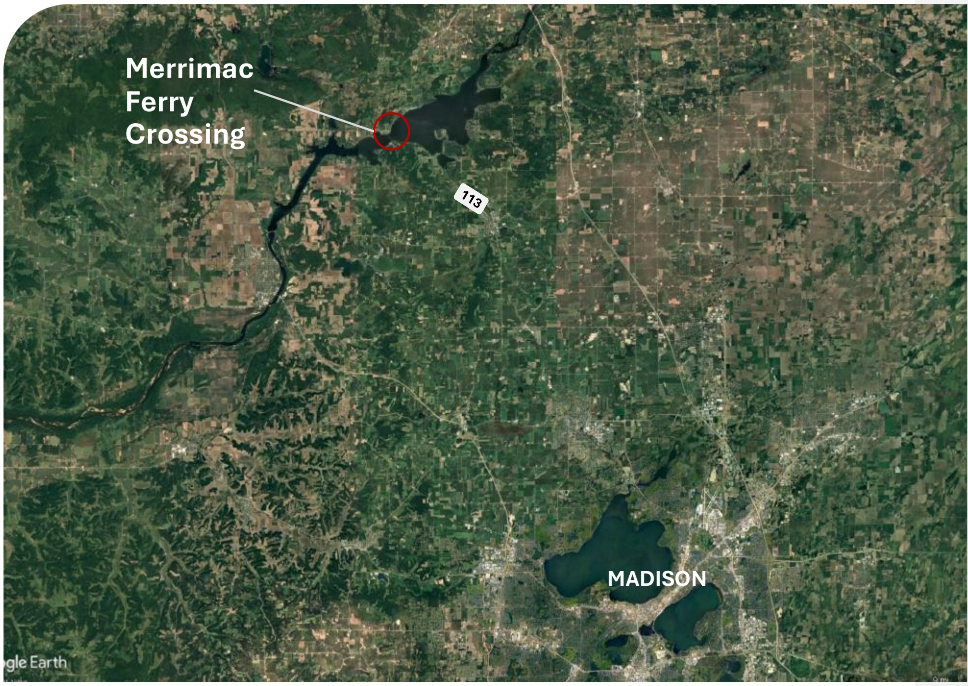



***Figure 3: Merrimac Ferry Crossing Location***

The current ferry carries up to 15 standard-size vehicles.  Standard single-rear-axle trucks and tow-behind campers are permitted on board, depending on their maneuverability, with a maximum weight limit of 16 tons per vehicle.

### Service Schedule

The ferry operates seasonally, stopping operations when the lake freezes over and the vessel cannot cross. Most years, the ferry is in operation between April and December. The winter shutdown period is used to complete necessary annual maintenance.

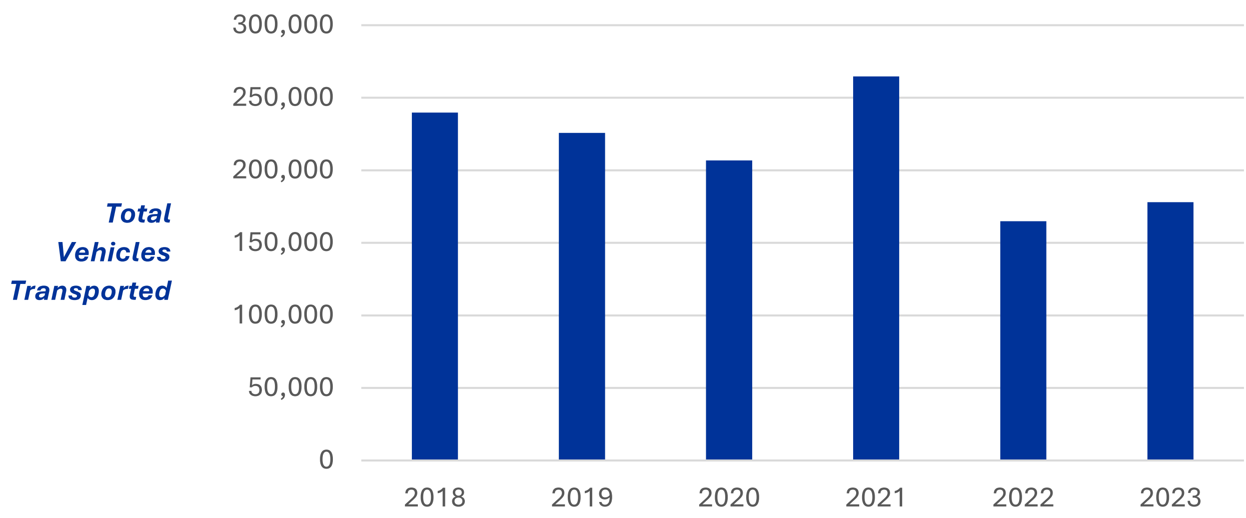
When in service, the ferry operates 24 hours a day, continuously making trips back and forth across Lake Wisconsin. Service is not provided on a fixed schedule, instead trips are made based on demand as vehicles and passengers queue at the landings. Breaks in service only occur when the vessel is out of service during scheduled fueling and maintenance or for emergency repairs.

## Ridership

Over recent years, ridership on the Merrimac Ferry has been impacted by the COVID-19 pandemic, vessel out of service time for maintenance and repairs, and weather variations. Ridership data collected over the past six years of operations (2018 to 2023) indicate an average of approximately 39,000 one-way crossings made by the Merrimac Ferry, carrying an average of over 220,000 total vehicles per year.

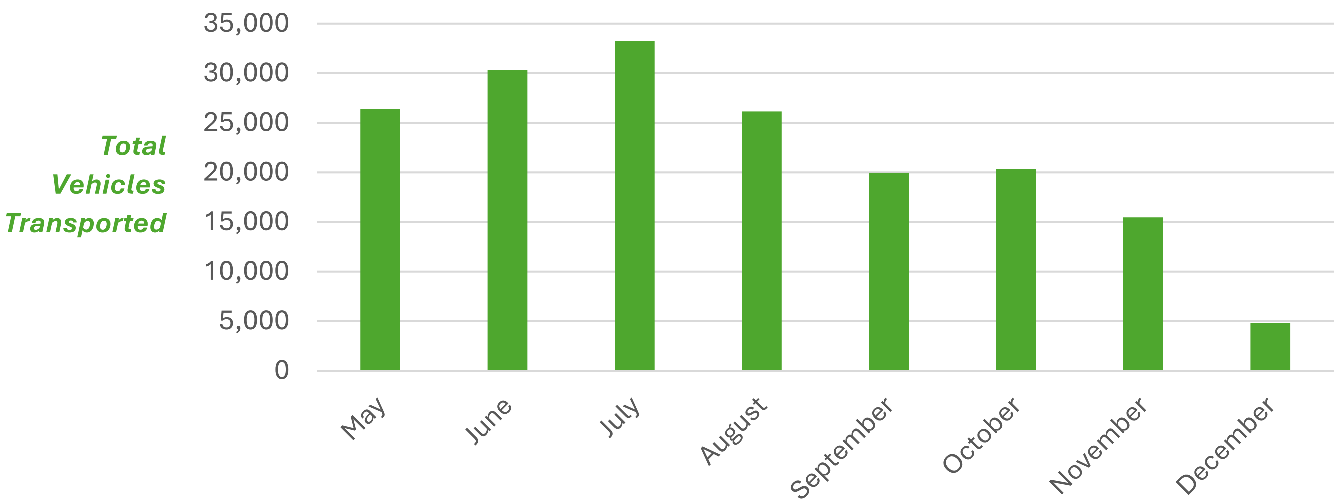
**Figure 4** provides an annual summary of vehicles carried.

*Figure 4: Merrimac Ferry Annual Ridership*




Demand typically peaks during the summer months, dropping off after September. **Figure 5** shows the monthly breakdown of vehicle riders from May to December of 2023.

*Figure 5: 2023 Merrimac Ferry Vehicle Ridership by month*



Walk-on and bicycle ridership typically follows similar monthly trends as vehicle ridership, experiencing higher demand during the summer months. In 2023, the Merrimac Ferry also carried a total of 10,620 pedestrians and 2,777 bicycles.

The current vessel capacity and service schedule generally meets or exceeds current and historical ridership demand. Vehicle queue lines at the Merrimac ferry landings are reported by operators to occur infrequently. Waits are most likely to be seen during afternoons on busy holiday weekends, especially Memorial Day and Fourth of July. Additionally, waits occasionally occur at the Merrimac landing between 7:00 AM to 8:00 AM as commuters travel toward Madison.

## Operations

### Governance

The Merrimac Ferry and landing facilities are state-owned components of the state highway system. WisDOT is the agency responsible for funding ferry operations and planning and implementing future improvements. Service is delivered through a partnership with Columbia County, whose staff manage ferry operations and maintenance under contract with the state. Ferry staff include four full-time operators, several standby operators, and one mechanic.

Due to the operating environment of the crossing, the vessel is exempt from U.S. Coast Guard requirements for both vessel construction and maintenance, as well as crew licensing.

### Vessel Operations

The *Colsac III* operates with a single operator staffed per 12-hour shift, and no deckhand. The vessel operator controls both the loading lights and the bow ramps from the pilot house. Traveler information for ferry users is provided via dynamic message boards, flashing advanced warning lights, email alerts and on the 511 Wisconsin Travel Information website[1].

### Operating Costs

The costs to operate the Merrimac Ferry have increased over the past 20 years. Labor and material costs are the largest cost components of Merrimac Ferry operations. A full breakdown of costs of the ferry's operating costs is shown in **Figure 6**.

[1] https://511wi.gov/#:Alerts

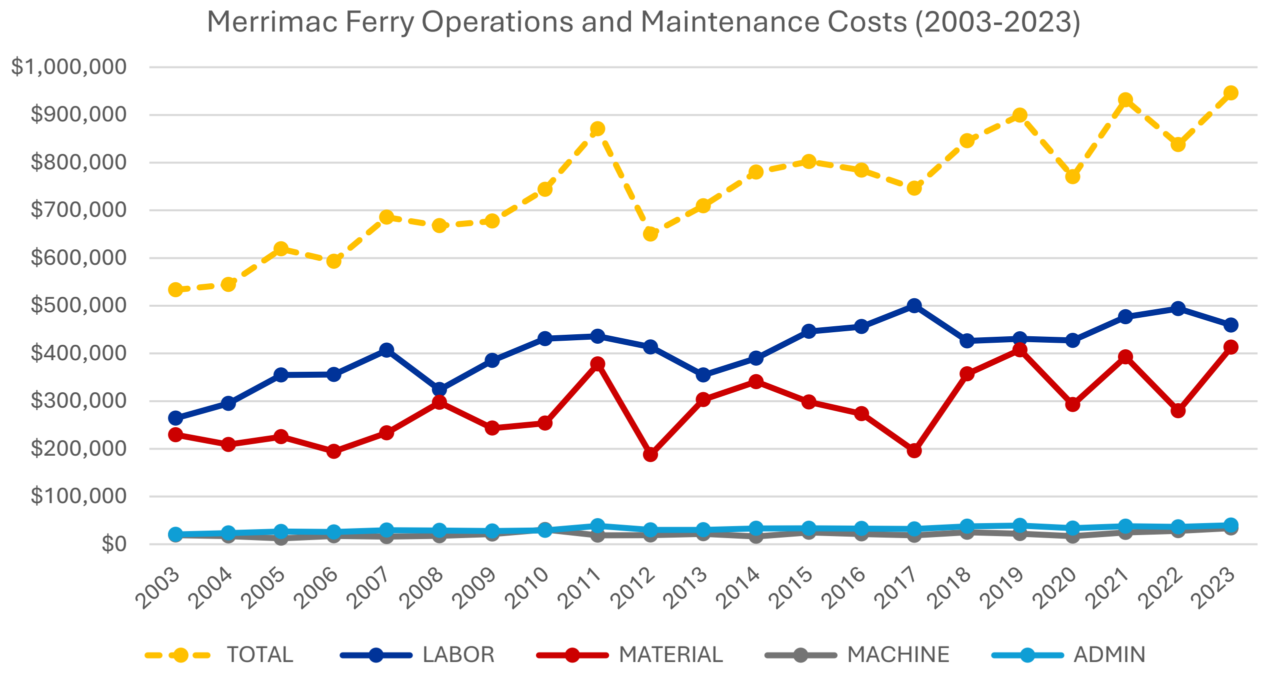



***Figure 6: Merrimac Ferry Operations and Maintenance Costs (2003-2023)***

In 2023, the Merrimac Ferry carried 178,041 vehicles, with an average operating cost of $4.77 per vehicle.

## Vessel

The current vessel, the *Colsac III*, was built in 2003. The *Colsac III* is a double-ended diesel-hydraulic powered cable ferry. **Table 1** outlines the main vessel characteristics.

***Table 1: Summary of the Colsac III***

| | |
|---|---|
| **Year Built** | 2003 |
| **Overall Length** | 105 feet |
| **Beam (Width)** | 44 feet |
| **Vehicle Capacity** | 15 standard-size cars |
| **Vehicle Lanes** | 3 |
| **Life Jacket Capacity** | 180 adult & 50 child |

## Conditions Assessment

A vessel inspection was completed in June 2024 by naval architecture and marine engineering firm Elliott Bay Design Group. The inspection included a physical inspection of onboard systems and vessel superstructure.

The vessel inspection revealed that the current hull and structure of the *Colsac III* are in excellent condition and could continue operation for roughly 25 more years with proper maintenance. However, the inspection also identified three key concerns for the existing ferry vessel: the **hydraulic system**, **drive cables**, and **firefighting system**. More details on the findings of the vessel assessment can be found in Appendix B, Attachment 1.

**Drive Cables:** The Merrimac Ferry operates with two guide cables and one drive cable. Guide cables are replaced every three to four years. Drive cables were typically replaced every 15 weeks; however, in recent years, drive cable replacement has occurred as frequently as every eight weeks. Cable wear consistently occurs in a specific location, likely due to cable dragging on the bottom of the channel in one portion of the crossing, collecting grit which then wears on the cable as it is compressed by the sheaves.

**Hydraulic System:** Due to the age of the existing vessel and its custom hydraulic system, WisDOT has had difficulties maintaining and securing parts for the existing system. The installed equipment is no longer supported by the manufacturers, and the design of custom equipment is not well documented, so designing repairs and procuring appropriate replacement parts has been challenging.

In addition, portions of propulsion hydraulic piping were observed to be flexible hose. It is recommended that these sections be replaced with ferrous piping to provide better fire protection.

**Fire Safety:** The current location of the fire suppression $CO_2$ cylinders within the engine compartment poses some concern. Relocation is recommended to improve accessibility and safety in case of an emergency as well as for inspection and maintenance. Additionally, improvements to the fire pump system are recommended to improve priming efficiency.

## Short-Term Recommendations

Short-term actions recommended to address these challenges and improve operations include the following:

- **Cable wash**- The addition of a cable wash system where the cable enters the vessel may reduce the collection of grit that is causing the cable to fail.
- **Hydraulic hose**- The current flexible hydraulic hose on the vessel should be replaced with ferrous piping, such as carbon steel or stainless steel, to provide better protection against fire and a rigid conduit for hydraulic oil.
- **Fire suppression system**- Updates are recommended to the existing fire suppression system to improve safety and ensure it can operate successfully in the event of a fire.


*Figure 7: South Landing in Okee*

## Landing Sites

Each ferry landing is a spur off the main road on each side of the crossing. The landings, shown in **Figure 7** and **Figure 8**, each consist of multiple key infrastructures including:

- Three parallel holding lanes
- Below grade cable anchor pits for the drive cable and two guide cables,
- Steel sheet pile bulkhead
- A concrete and asphalt ramp which supports the ferry ramps during vehicle and passenger loading and unloading.

### Conditions Assessment

Landing site infrastructure conditions at both ends of the route were assessed by KPFF Consulting Engineers via a landing facility inspection also completed in June 2024. The inspection focused on shore ramps, upland paving condition, drive and guide cable anchor pits, and supporting infrastructure.

### Landing Site Recommendations

The inspection identified minor repairs and improvements to be addressed over the short- and long-term, including potential maintenance issues and suggested equipment for monitoring. More details on landing site conditions and assessment findings can be found in Appendix B, Attachment 3.


*Figure 8: North Landing in Merrimac*

# Review of Future Operations Opportunities

To provide context for understanding the opportunities and challenges of the current county-based operations and maintenance service model, the following information was reviewed:

- Overview of ferry service provider models and key opportunities and challenges for agencies
- Summary of current Merrimac Ferry operations and assessment of historical operating costs
- Comparison to similar North American cable ferry operations, service levels, and operating costs

The Merrimac Ferry's operational and maintenance profile were compared to other similar ferries to identify potential operational efficiencies and improvements. While differences in service levels, vessel sizes, and crossing lengths make direct comparison of cable ferry operating costs challenging, the benchmarking review provided helpful context for review of Merrimac Ferry operations. The similar ferry operators included:

- **Buena Vista Ferry**: Located in Oregon, this six-car cable ferry route is shorter than the Merrimac Ferry but has a very similar operating organization.
- **Wheatland Ferry**: Also in Oregon, the Wheatland Ferry is also a historic cable ferry.
- **Canby Ferry**: The final Oregon ferry reviewed, this cable ferry carries 6 cars.
- **Ironton Ferry**: This Michigan cable ferry is the smallest ferry reviewed.
- **J-Mack Ferry**: Built in 1969, this ferry connects two segments of California State Route 220.
- **Denman Island – Buckley Bay, B.C.:** The longest cable ferry crossing in the world**.**

**Table 2** summarizes the key operating characteristics of each service in relation to the Merrimac Ferry.

*Table 2: Operating Characteristics of Merrimac Ferry and Comparative Services*

| | Merrimac | Buena Vista | Wheatland | Canby | Ironton | J-Mack | Denman Island – Buckley Bay |
|---|---|---|---|---|---|---|---|
| **Vehicle Capacity** | 15 cars | 6 cars | 9 cars | 6 cars | 3 cars | 6 cars | 45 cars |
| **Route Length** | 2,640 ft | 720 ft | 580 ft | 670 ft | 610 ft | 400 ft | 6,435 ft |
| **Owner** | WisDOT | Marion County Public Works | Marion County Public Works | Clackamas County | Charlevoix County | Caltrans | BC Ferries |
| **Operator** | Columbia County | Marion County Public Works | Marion County Public Works | Clackamas County | Charlevoix County | Caltrans | BC Ferries |
| **Staff/ Crew Levels** | 1 operator | 1 operator | 1 operator | 1 operator | 1 operator | 1 operator | 1 operator, 3 crew |
| **Seasonality** | Seasonal (Apr-Dec) | Year-round | Year-round | Year-round as conditions allow (~225 days/year) | Seasonal (Apr-Nov) | Year-round | Year-round |
| **Approx. Annual Operating Cost** | $.9M | $1.3M | | $.6M | $.4M | $1.6M | $6.9M (CAD) |

## Key Findings

The review of operational opportunities indicated that Merrimac Ferry operations and costs are in line with other U.S. cable ferry operations and that no major operational changes would be recommended to improve service. It appears unlikely that changes to the service delivery model, such as contracting vessel operations and maintenance to a private operator or utilizing WisDOT staff for direct agency delivery of service, would result in cost savings.

Additional details on this analysis can be found in Appendix C.

# Potential Alternatives for Future Merrimac Ferry Service

## Vessel Concepts

Development of long-term recommendations for the Merrimac Ferry crossing focused on potential vessel alternatives to address the current operational challenges and long-term service needs for the crossing. Based on the operating and service requirements for the crossing, the following foundational assumptions were applied consistently across all alternatives.

- **Vessel size and capacity.** Because the current 15-car vessel capacity is adequate to meet typical and forecast vehicle demand, alternatives development assumed the same vessel size, vehicle capacity, and passenger capacity to minimize operating changes and required shoreside improvements.
- **Service levels.** WisDOT identified maintaining the current service levels and on-demand crossing availability as a priority for assessment of alternatives.
- **Design life.** The condition of the existing hull indicated that it could last for roughly 25 more years, meaning that it would meet a 25-year design life, which was identified as the minimum requirement for all vessel alternatives.

To improve reliability, the *Colsac III* could either be significantly retrofitted or replaced with a new vessel. Thus, the five vessel alternatives that were developed broadly fall into one of these two categories. The first three alternatives involve preserving and maintaining the hull and superstructure of the *Colsac III* but making certain improvements to meet identified goals. Development of potential reuse of the existing hull included analysis of the weight added by replacement or new systems to verify design feasibility. The second category of alternatives involves replacing the *Colsac III* with a new vessel.

The five alternatives are summarized in **Table 3** below.

*Table 3: Potential Alternatives*

| # | Alternative Name | Description |
|---|---|---|
| ***Colsac III* Preservation Alternatives** | | |
| **1** | Vessel Repower- Diesel | Replace the existing diesel engines with new diesel engines; add new hydraulics and safety updates to the *Colsac III* |
| **2** | Propulsion System Replacement- Hybrid | Keep the existing *Colsac III* hull and replace the existing diesel engines with new hybrid diesel-electric propulsion and house |
| **3** | Propulsion System Replacement- All Electric | Keep the existing *Colsac III* hull and replace the existing diesel engines with new all-electric propulsion and house |
| **New Vessel Alternatives** | | |
| **4** | New Hybrid Vessel | Purchase a new vessel that has hybrid diesel-electric propulsion system |
| **5** | New All Electric Vessel | Purchase a new vessel that is all-electric and has no diesel engines |

## Alternatives Assessment

After defining the alternatives, an analysis was undertaken to compare them to identify the most promising future options.

### Assessment Approach

Once deemed feasible, the proposed options were then compared to each other using seven key criteria.

1. **Systems Reliability**: Are some alternatives more reliable and less prone to part or system failures than others?
2. **Ease of Maintenance**: What is the availability of spare parts and technical support for each alternative? What are the winter layup requirements?
3. **Service Levels Impacts:** How well can the alternatives maintain the current service level?
4. **Crewing Needs:** How many crew members are needed to support vessel operations?
5. **Fuel/Energy Consumption and Emissions Production:** How much power does each alternative use? Which alternatives will produce the most greenhouse gas emissions?
6. **Rough-order-of-magnitude (ROM) Vessel Capital Cost:** At a high level, what will the purchase cost for each alternative be?
7. **Shoreside Improvements Needs:** Are shoreside improvements needed to support the alternative? If so, how extensive are they?

These categories for analysis were used to gather initial information to inform the next phase of detailed analysis on the proposed alternatives.

## Findings

WisDOT has identified maintaining current service levels and improving vessel reliability as priorities for future service. All potential alternatives except for the diesel repower of the *Colsac III* (1) will facilitate improved cable life by providing the opportunity to install an updated bull wheel arrangement. The improved cable life will significantly reduce the vessel out of service time and could result in savings of $20,000 to $51,000 per year in 2024 dollars.

Of the two categories of potential alternatives, the first involves maintaining the current hull while the second involves purchasing a completely new vessel. The current hull is in good condition and can be easily maintained, but purchasing a new vessel provides an opportunity for all aspects of vessel design to be revisited, including multi-modal/ADA access, and allows previously identified shortcomings to be addressed.

Potential alternatives with all-electric propulsion (Potential Alternatives 3 and 5) have the lowest maintenance requirements and greatest emissions reduction, but they would result in service schedule impacts and shoreside improvement requirements to support the necessary electric charging. Additionally, depending on future diesel prices and electrical energy pricing structures, acquiring electricity for these potential alternatives could be more expensive than current diesel energy costs.

Phase II of this project will be needed to confirm anticipated energy costs based on the energy needs and charging schedule resulting from more detailed vessel design.

The hybrid diesel-electric options (Potential Alternatives 2 and 4) would result in modest emissions savings but would have the benefit of not requiring changes to the current service tempo. Additionally, compared to a diesel re-power of the current vessel (Potential Alternative 1), the hybrid-electric options would have reduced fuel use, resulting in lower fuel costs for operations.

A comparison of all alternatives across key categories is shown in **Table 4**. Green text indicates that an alternative has a notable benefit in that analysis category, while red text indicates a notable drawback. The comparison also identifies planning-level cost estimates by component based on conceptual design of potential alternatives. Additional details on the alternatives assessment process, assumptions used to inform **Table 4**, and assessment findings can be found in Appendix D.

*Table 4: Comparison of Potential Alternatives*

| | Preserve and Maintain *Colsac III* | | | New Vessel | |
|---|---|---|---|---|---|
| | 1. Repower | 2. Existing Hull + Hybrid | 3. Existing Hull + All Electric | 4. New Hybrid Vessel | 5. New All-Electric Vessel |
| **Systems Reliability** | **Similar cable life** | **Improved cable life** | **Improved cable life** | **Improved cable life** | **Improved cable life** |
| *Annual Cable Costs* | *$45k - $63k* | *$12k - $25k* | *$12k - $25k* | *$12k - $25k* | *$12k - $25k* |
| *Out of Service Time* | ***Similar*** | ***Decreased*** | ***Decreased*** | ***Decreased*** | ***Decreased*** |
| **Ease of Maintenance** | **Minimal Increase** | **Moderate Increase** | **Greatest Increase** | **Moderate Increase** | **Greatest Increase** |
| **Service Tempo Impacts** | **No impact** | **No impact** | **Service tempo impacts** | **No impact** | **Service tempo impacts** |
| **Crewing Needs** | 1 operator | 1 operator | 1 operator | 1 operator | 1 operator |
| **Fuel/Energy Consumption and Emissions** | 24,800 gal/yr | 23,100 gal/yr | 203,600 kWh | 23,100 gal/yr | 203,600 kWh |
| *Annual Energy Costs* | ***Similar*** | ***~7% savings*** | ***Likely more expensive*** | ***~7% Savings*** | ***Likely more expensive*** |
| *Carbon Emissions* | ***250 metric tons*** | ***240 metric tons*** | ***0 metric tons*** | ***240 metric tons*** | ***0 metric tons*** |
| **ROM Vessel Capital Cost** ***includes 20% contingency*** | **$2.2M** | **$6.9M** | **$6.3M** | **$7.6M** | **$7.0M** |
| **Shoreside Improvements Needs** | **None/Minimal** | **None/Minimal** | **Will be needed ~$3.2M** | **None/Minimal** | **Will be needed ~$3.2M** |

## Key Considerations for Future Analysis

While more detailed design is required to fully understand potential project impacts and future operational considerations, several key elements were identified through development conceptual-level vessel options as key considerations for analysis in future project phases.

### Vessel Refurbishment/Construction Impacts

As the project is located on Lake Wisconsin in an area with no local shipyards or dry dock facilities, haulout of the existing vessel or assembly of a new vessel would occur at the Okee landing, with work completed in place near the shoreline during the winter closure. It is anticipated that preservation and reuse of the existing hull would take more time than installation of a new vessel, presenting potentially greater environmental and service impacts.

### Shoreside Electric Charging Requirements

Potential alternatives that would utilize shoreside electric charging would require installation of charging equipment and improvements to bring the required power to the site at one of the two ferry landings. **Figure 9** identifies preliminary infrastructure needs and proposed layout of charging equipment.

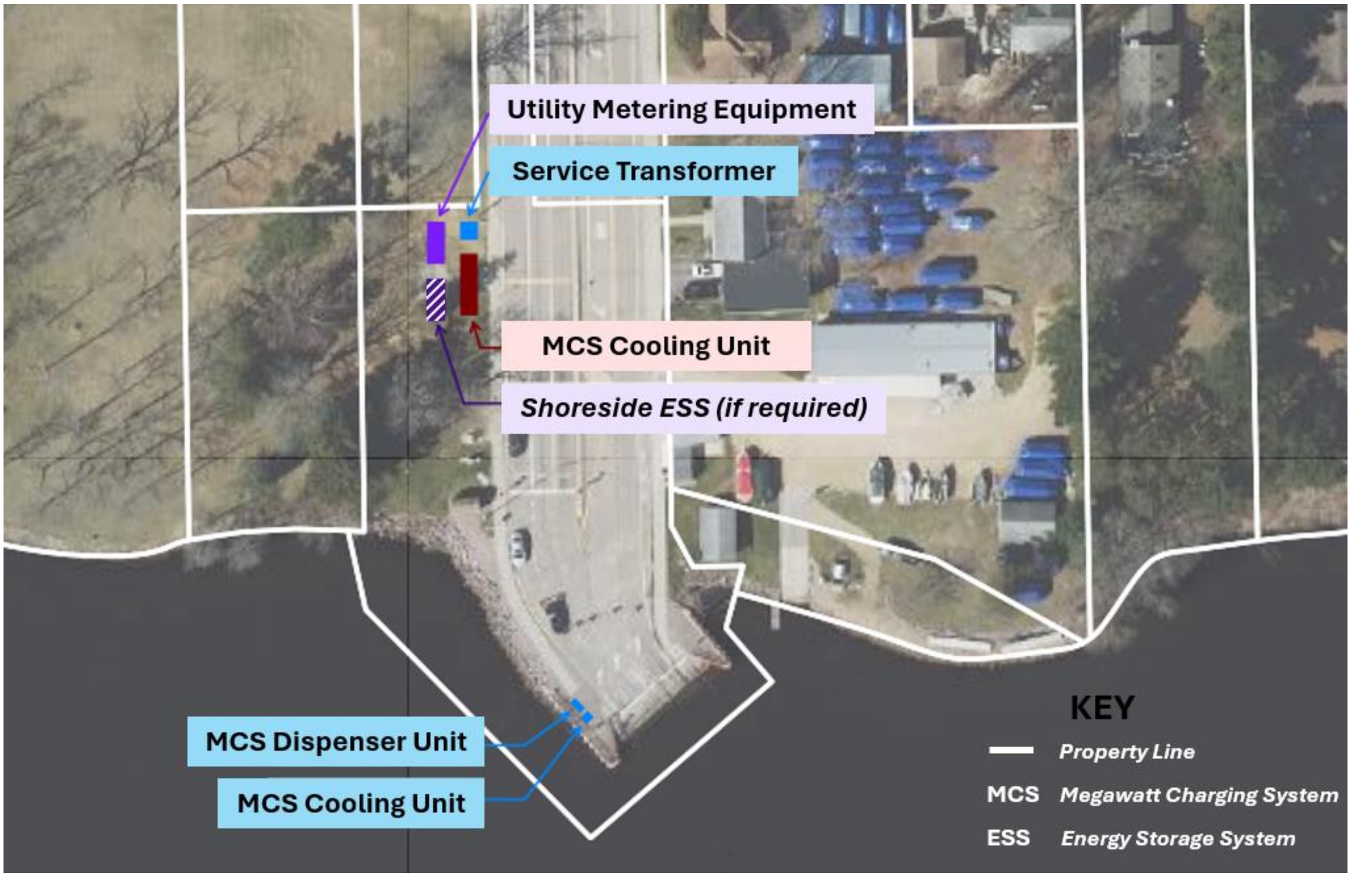



*Figure 9: Potential Layout for Charging Infrastructure*

Upon initial review, the southern landing in Okee was the preferred location for installation of charging infrastructure to support needed for any all-electric alternatives, due to the existing presence of the Merrimac Ferry maintenance shed and greater landing control by WisDOT. However, through coordination with Alliant Energy, significant challenges in supporting electric charging equipment at the southern landing were identified. These include:

- **Reliability**. The southern ferry landing is further from the nearest substation, and the existing overhead line between the substation and the south ferry landing is frequently out due to tree damage. Alliant identified that the electrical capacity at the northern landing is higher and that the landing itself is closer to the substation with fewer reliability challenges.
- **Implementation Timeline:** A current planned project will widen and add shoulders to WIS 113, from County J to WIS 188. The roadway project requires right-of-way acquisition, and it is currently unknown how much right-of-way will need to be acquired and if locations would conflict with the potential locations of new charging-related utility infrastructure. To avoid the potential costs associated with tearing out and relocating new electrical equipment and infrastructure, it is advised that any shoreside charging project on the southern end not be undertaken until completion of the highway project in 2029. Any planning for future improvements will require coordination with planned projects as well as with Alliant Energy.

### *Service and Schedule Implications*

Converting to an all-electric vessel would require additional time to be spent at a landing to charge the vessel batteries. With the current state of battery technology, all-electric vessels need to charge more frequently than a diesel vessel needs to refuel. As a result, **vessels will need to spend more time out of service to charge.**

#### Potential Mitigation Measures

To help reduce out of service time, **more batteries** can be installed on the vessel, though this comes with higher capital costs and lower operating efficiency from added equipment weight. Additionally, onshore batteries can be added to support more rapid charging with a smaller impact on the utility grid.

**Dynamic signage** that can be updated with ferry status in real time could be placed at strategic locations along highways and connecting roadways. Providing improved information to customers through these signs can help reduce customer inconvenience by providing them with ample time to select alternate routes or know when to return to make the ferry crossing.

**Alternative vessel types** such as those that use overhead electrical cables or an underwater cable could allow the vessel to use 100% electrical power while running continuous service. However, the route's length poses challenges for such options.

### *Energy Costs*

Converting to an all-electric will result in operational costs associated with electricity use. Unlike fuel costs, electricity costs stem from the amount of electricity used and the highest electricity demand peak. **Rapidly charging vessels directly from the grid will cause high peak demands, leading to high electric utility bills for the ferry.** Additionally, higher peak demands will require **more expensive upgrades to utility distribution equipment**.

#### Potential Mitigation Measures

To help reduce peak demand and associated electricity costs, **onshore batteries** can be installed. These batteries would draw low, consistent levels of electricity from the grid while the ferry is operating. The ferry would then charge by connecting to the batteries as opposed to the grid, reducing energy costs and impact on the utility grid.

### *Potential Emissions Reductions*

Converting to an all-electric propulsion system would provide **the greatest reduction in onsite greenhouse gas emissions**. However, shoreside charging for all-electric propulsion would be powered by the current electricity grid which is not yet emissions free. A hybrid propulsion system would result in fewer onsite emissions savings, as diesel fuel would still be burned to power the onboard generator.

# Next Steps

The next phase of the Merrimac Ferry Performance and Reliability Improvement Study will build upon the findings and recommendations from this Study. Phase II is anticipated to include the following elements.

## Preliminary Design of Alternatives

Immediate next steps for this project include further definition of the scope of alternatives for Phase II, which will focus on environmental review of the proposed alternatives. Vessel alternatives and associated shoreside improvements will be advanced to a preliminary design level to inform assessment and comparison of alternatives, including both short- and long-term project effects. Preliminary design will provide project information to support more detailed analysis of the following key elements:

- **Project scope and impacts:** While conceptual design activities completed in Phase I indicate that no in-water structural work is anticipated as part of this project, further design work is needed to confirm that is the case for all alternatives.
- **Project costs:** Conceptual design provides useful rough-order-of-magnitude (ROM) costs, but significant contingency costs are needed due to uncertainties at this stage. Further design efforts will inform refined cost estimates.
- **Energy costs:** More detailed vessel design is needed to finalize the assumed energy needs/energy profile of the vessel, including finalization of the number and capacity of batteries on the vessel for hybrid and electric alternatives. With a refined profile, more detailed energy costs for fuel or electricity can be developed for each vessel.
    - **Utility costs:** A refined energy profile for all-electric options will create a better understanding of distribution infrastructure needs for electric utility improvements and associated costs.
- **Service impacts**: A refined vessel energy profile will allow final development of a proposed charging schedule for all-electric vessel options. Continued coordination with Alliant Energy will be needed to finalize charging schedules.
    - Additional vessel design will also support construction phasing and planning activities that will allow for additional detail about temporary service interruptions that will result from onsite vessel construction.

## Public and Stakeholder Engagement

Engagement with the public and key stakeholders will be conducted to gather feedback on project alternatives to inform project design and identify potential impacts and concerns. Engagement efforts will target key audiences such as:

- Merrimac Ferry users
- Columbia County and Sauk County residents
- Businesses located near ferry landings
- Regional tourism interests
- Bicycle organizations interested in U.S. Bike Route 30
- National and State Parks representatives and users

## Agency Coordination and Environmental Review

To comply with potential future federal and state funding requirements, the project will be required to complete the National Environmental Policy Act (NEPA) and state Wisconsin Environmental Policy Act (WEPA) processes. Using the NEPA process, agencies evaluate the environmental and related social and economic effects of their proposed actions. As the crossing is listed on the National Register of Historic Places, the project will also be required to complete the Section 106 review process to identify and assess potential impacts to the historic property. Early coordination with the lead federal agency and the State Historic Preservation Office is recommended to coordinate approach for Section 106 compliance and understand the likely class of action for NEPA/WEPA review.

Additionally, initial outreach with regulatory agencies including U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, and Wisconsin Department of Natural Resources is recommended to verify permitting needs and identify initial considerations and potential project impacts.

Landing site improvements to support charging are anticipated to occur at the northern landing and will require coordination with Columbia County Planning and Zoning to verify the final permitting needs of the selected alternative and as part of the permit application and review process.

Additional information on future environmental review can be found in Appendix E.

## Utilities Coordination

Continued coordination with the local utility, Alliant Energy, is vital to understanding the infrastructure needs and potential costs of vessel alternatives that will use electric charging. Through preliminary coordination, Alliant has indicated support for the project and has provided initial information on utility upgrades needed to support vessel alternatives that require shoreside charging.

Continued coordination with Alliant Energy will be critical throughout planning and design for alternatives that include shoreside electric vessel charging. Alliant Energy will be a key partner in coordinating the project with near- and long-term local energy improvements, as well as pursuit of funding opportunities for project alternatives that include an emissions reduction component.

## Exploration of Funding Opportunities

For any of the potential alternatives, advancement of project will necessitate development of a funding plan to meet capital cost needs. As estimated costs are refined in the next project phase, WisDOT can begin to pursue external funding sources to cover the capital costs of the project. Several federal and state grant funding opportunities are available as potential opportunities for the Merrimac Ferry project and are recommended for further exploration. Assessment of grant funding opportunities will include review of eligibility requirements, application scoring criteria, and eligible project activities.

Numerous federal funding opportunities are available to support transportation investments. Currently, many of these opportunities are part of the Justice40 initiative which aims to have 40% of certain federal investments flow to communities that are overburdened by pollution and have been marginalized by underinvestment.[2] Specifically applicable communities are defined per funding opportunity, though a common mapping tool used to identify them is the Climate and Economic Justice Screening Tool (CEJST). Though not all federal funds need to flow to these communities, applications that serve Justice40 communities will be more competitive. Per CEJST, the Merrimac Ferry is not located in a disadvantaged community which may impact the competitiveness of this project's federal grant applications for programs that include Justice40 criteria.

Additionally, for emissions reduction projects, higher volumes of emissions reductions are more competitive for grants like the Federal Transit Administration (FTA) Electric or Low Emitting Ferry Pilot Program or the U.S. Department of Transportation (USDOT) Carbon Reduction Program. For these specific opportunities, the electric ferry alternatives would decrease ferry emissions the most and thus likely be the most competitive for receiving funding.

Per the initial review of available funding opportunities, the following grant programs were identified as top opportunities for further exploration:

- Federal Highway Administration (FHWA) Construction of Ferry Boat and Ferry Terminal Facilities Program[3]
- USDOT Rebuilding America Infrastructure with Sustainability and Equity (RAISE) Grants[4]
- Maritime Administration (MARAD) Port Infrastructure Development Program (PIDP) Grant[5]

A summary of potential federal and state grant funding opportunities is provided in Appendix F.

## Conclusion

The five potential alternatives identified by Phase I of this *Merrimac Ferry Performance and Reliability Study* are recommended for further analysis and design efforts in future phases to support service reliability and provide long-term, sustainable ferry operations that will support the economic and transportation needs of the region. Through Phase II, a clearer picture of the alternatives will be developed with the aim of identifying a recommended alternative for implementation.

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[2] https://www.whitehouse.gov/environmentaljustice/justice40/

[3] https://www.fhwa.dot.gov/specialfunding/fbp/

[4] https://www.transportation.gov/RAISEgrants/about

[5] https://www.maritime.dot.gov/PIDPgrants

# PURPOSE AND NEED MEMO

## Appendix A

# Merrimac Ferry Performance and Reliability Improvement Study

## Purpose and Need

The purpose of the Merrimac Ferry Study is to develop alternatives that improve service reliability, reduce vessel emissions, and meet the future travel demand capacity needs for all modes of travel by the ferry service for both the short- and long-term future of this ferry service.


*COLSAC III*

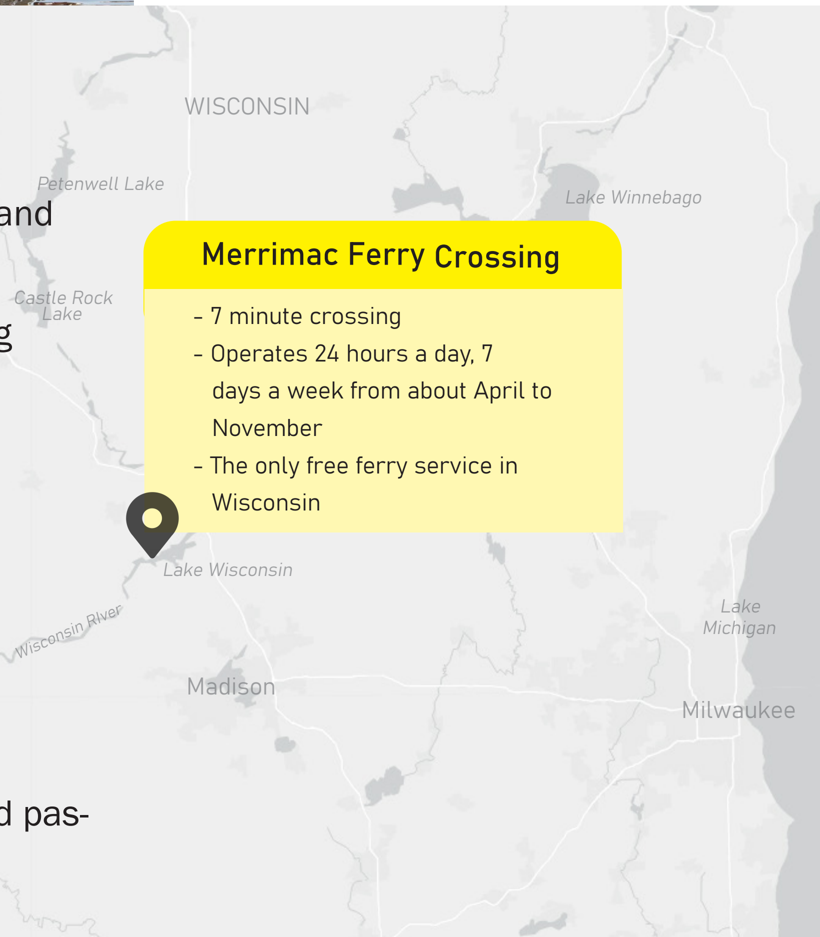
15-car cable ferry built in 2003

## NEEDS OF THE CURRENT AGING VESSEL

- Increasing maintenance requirements and vessel time out of service
- Difficulty procuring and repairing obsolete vessel parts
- Environmental impacts of the diesel ferry

## PROJECT GOALS

1. Provide long-term, sustainable ferry operations to support the economic and transportation needs of the region
2. Improve service reliability by reducing maintenance downtime
3. Reduce vessel emissions
4. Support tourism and local businesses
5. Ensure a sustainable future for this regionally and historically significant crossing
6. Improve safety for both operators and passengers

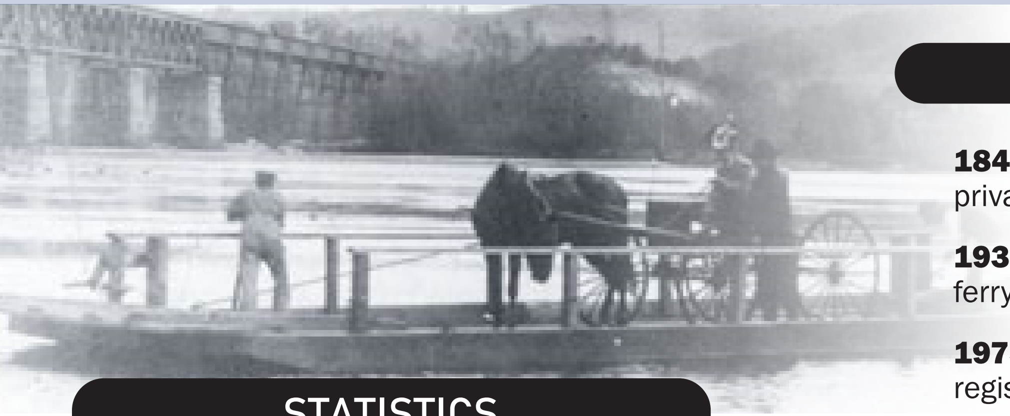



**Merrimac Ferry Crossing**

- 7 minute crossing
- Operates 24 hours a day, 7 days a week from about April to November
- The only free ferry service in Wisconsin

# Merrimac Ferry Performance and Reliability Improvement Study

## Purpose and Need



## HISTORY

**1844**: The Merrimac Ferry launched as a private operation

**1933**: The State of Wisconsin aquired the ferry and began operating as a free service

**1975**: The route was added to the historic register

## STATISTICS

**38,000**
Average* annual crossings

**207,000**
Average* vehicles transported annually

**215**
Annual metric tons of $CO_2$ produced, equivalent to 51 typical cars

**10,624**
pedestrians &
**2,780**
bicycles
transported in 2023

*Based on the last 6 years of service

## REGIONAL SIGNIFICANCE

### Recreational Access

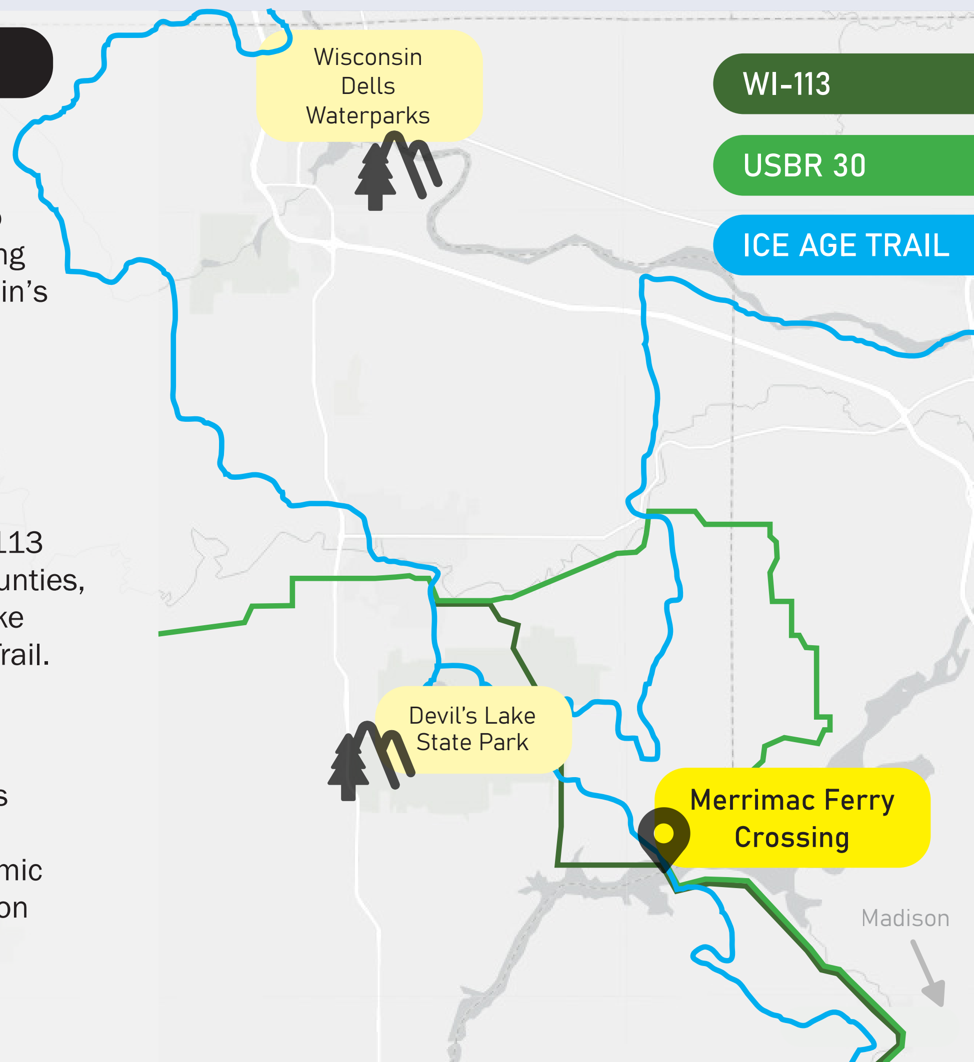
The crossing supports access to nearby local attractions, including Devils Lake State Park, Wisconsin's most popular state park.

### Key Link

The ferry, with no nearby bridge alternative, is the sole link connecting Wisconsin Highway 113 between Sauk and Columbia counties, U.S. Bike Route 30 (269-mile bike route), and the historic Ice Age Trail.

### Economic Benefits

The ferry transports and attracts visitors to Columbia and Sauk counties, where the total economic impact of tourism was $2.2 billion in 2023.



**WISDOT ID: 5640-01-08**

# Merrimac Ferry Performance and Reliability Improvement Study

## Purpose and Need

August 2024

# Contents

# 1. Merrimac Ferry Study Overview

## 1.1 Location and Termini

Project Limits: Wisconsin River/Lake Wisconsin Crossing segment of WIS 113: WIS 78 to Palisade Street (Town of Westpoint to Village of Merrimac) in Columbia and Sauk Counties within the State of Wisconsin (Figure 1).

The entire study limits are approximately 0.6 miles in length or 3,340 feet. The ferry water crossing is approximately 0.45 miles or 2,398 feet in length.

The study's termini are consistent with the Federal Highway Administration (FHWA) regulations at 23 Code of Federal Regulations (CFR) 771.111(f):

I. Connects logical termini and is of sufficient length to address environmental matters on a broad scope,
II. Has independent utility and will be a reasonable expenditure of funds even if no additional transportation improvements in the area are made, and
III. Does not restrict consideration of alternatives for other reasonably foreseeable transportation improvements

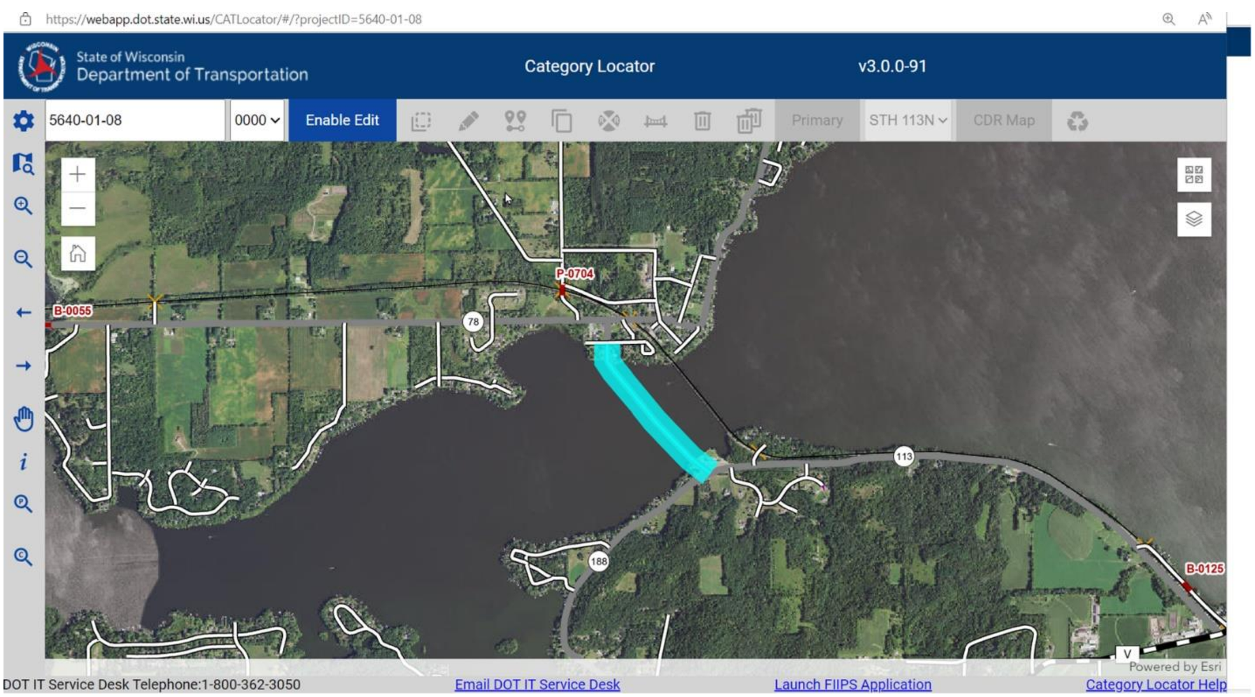



*Figure 1 Location Map (WisDOTGIS)*

## 1.2 Route Description

The Merrimac ferry crosses the Wisconsin River/Lake Wisconsin between Columbia and Sauk Counties, serving as a link on WIS 113 between the Town of Westport, on the south bank, and the Village of Merrimac on the north and is Wisconsin's only free ferry.

Ferry service has been provided in this area for more than a century. In 1844, four years before Wisconsin became a state, Chester Mattson, the second settler on the site of the village of Merrimac, obtained charters to provide ferry service at this location. The ferry was operated long before the development of a regular roadway.

The State of Wisconsin has operated ferry service at this specific location as a free crossing since 1933 and both the Ferry and terminals are owned by the State of Wisconsin as part of the state highway system. The State of Wisconsin contracts with Columbia County for operations and maintenance of the Ferry and Terminals. The current vessel, the *Colsac III*, was constructed in 2003 and is a diesel-propelled cable ferry. The ferry operates seasonally, typically between April to December, and shuts down for the winter months when Lake Wisconsin freezes over. Between 2018 and 2023, the ferry performed an average of over 37,000 crossings, transporting 207,000 vehicles annually.

The Wisconsin Department of Transportation (WisDOT) is evaluating vessel and service alternatives for the future of the Merrimac Ferry Crossing. This first study phase, the Merrimac Performance and Reliability Improvement Study, will assess the current state of the *Colsac III* and evaluate long-term vessel rehabilitation and replacement alternatives as well as short term operational recommendations.

## 1.3 Route Importance

### 1.3.1 Historical Significance

The Merrimac Ferry crossing was added to the historic register in 1975 after serving as a connecting route for over a century. Its continued operation connects residents and visitors to the area's past and serves to maintain the historic character of the region.

### 1.3.2 Cross County Highway Connection

WisDOT road classifications categorize the ferry crossing as part of Wisconsin Highway 113 as a major collector, connecting to the minor arterial WIS 78/113 on the Sauk County (north) side of the route.

### 1.3.3 Maintain Access to Local Businesses, Restaurants, and Residences

The ferry crossing supports regional cross-county access and provides a direct route for visitors and commuters to the local communities of Merrimac, Okee, and Lodi. The route continues to draw tourists to Merrimac and Okee, supporting six local restaurants in the areas directly surrounding the historic crossing and other businesses in the wider vicinity.

### 1.3.4 Support Tourism

An estimated 150,000 to 200,000 annual visitors travel through the Merrimac Village, with up to 1,200 vehicles ferried across the Wisconsin River on peak summer days. With a year-round population of just over 500, Merrimac Village relies on the economic contributions of these visitors. The ferry crossing provides a commuter and recreational short-cut to important Wisconsin tourism destinations, such as Devils Lake State Park and the Wisconsin Dells from the greater Madison area.

### 1.3.5 Support Local Residents and Commuters

The ferry crossing serves commuters from surrounding communities. Commuters can benefit from a shorter commute distance and time rather than utilizing alternate highways that are located approximately twelve miles from Wisconsin Highway 113 (Figure 2). In addition, the crossing is used by emergency response services when it provides a time savings.

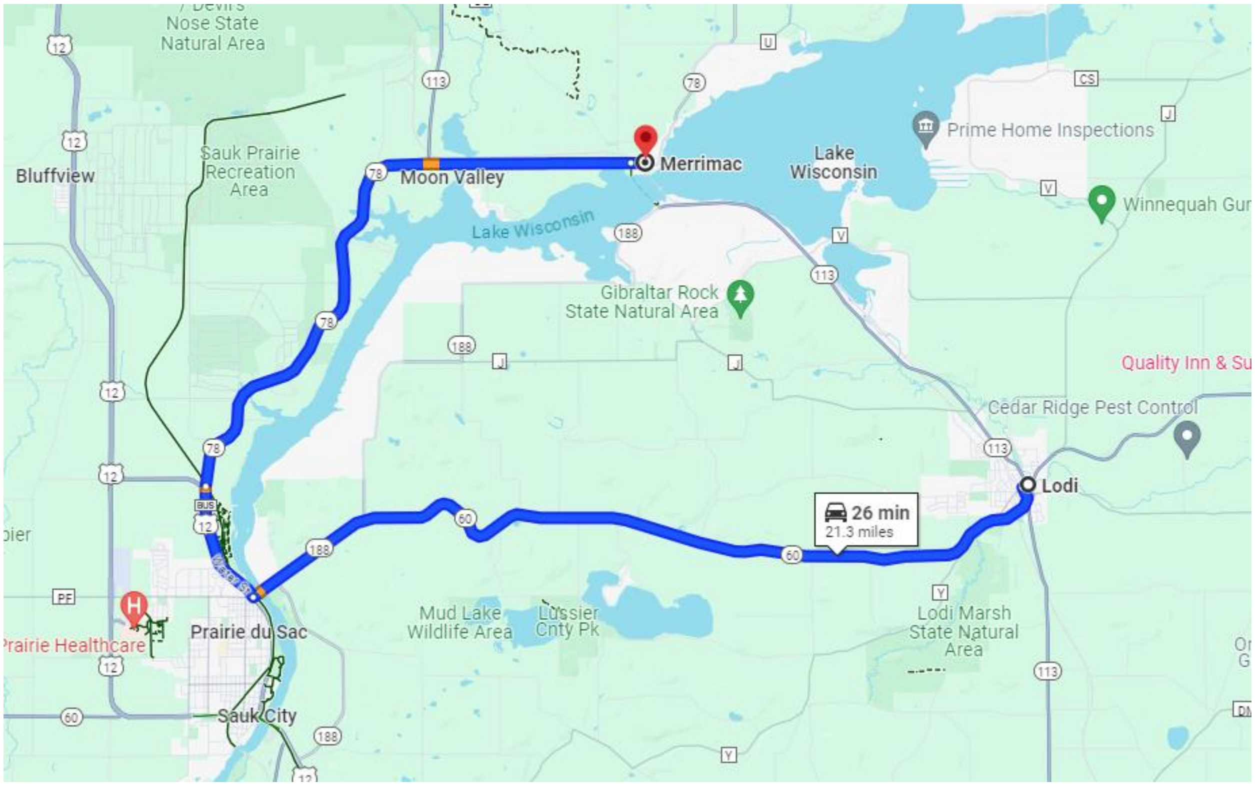



*Figure 2 Travel time from Lodi to Merrimac, not utilizing ferry crossing (GoogleMaps)*

### 1.3.6 Ferry Crossing is Regularly Utilized by Residents and Tourists

Ridership data collected over the past six years of operations (2018-2023) show a yearly average of **38,054** crossings made by the Merrimac Ferry with an average of **207,334** vehicles transported per year (Table 1).

| Year | Trips Recorded | Total Vehicles Transported |
|---|---|---|
| 2018 | 46,613 | 239,783 |
| 2019 | 40,811 | 225,762 |
| 2020 | 35,213 | 206,775 |
| 2021 | 44,540 | 264,728 |
| 2022 | 26,677 | 130,291 |
| 2023 | 34,471 | 176,662 |

*Table 1 Merrimac Ferry Ridership 2018-2023 (WisDOTColumbiaCo)*

### 1.3.7 Maintain Key Segment of Ice Age Trail

Along with serving as a link on Wisconsin Highway 113, the route is a connecting link of the Ice Age National Scenic trail. The 1,000-mile Ice Age Trail is one of the 11 designated national scenic trails in the U.S. The ferry crossing connects two of the Ice Age trail alliance communities, Baraboo and Lodi. The crossing supports community and transit access between three designated State Natural Areas: Devil's Nose, Palfrey's Glen, and Gibraltar's Rock.

### 1.3.7 Maintain Key Segment of U.S. Bike Route 30

The route is a connecting link of U.S. Bike Route 30, a 269-mile bicycle route that crosses the state. The ferry supports group bicycle events, including annual rides of over 1,000 riders.

# 2. Study Purpose

The purpose of the Merrimac Ferry Study is to develop alternatives that improve service reliability, reduce vessel emissions, and meet the future travel demand capacity needs for all modes of travel by the ferry service for both the short- and long-term future of this ferry service.

# 3. Ferry Crossing Needs

## 3.1 Vessel Time out of Service

With its frequent crossings and high demand during the peak season it is important to maintain the reliability of the *Colsac III*. Emergent maintenance on the aging vessel equipment has caused a spike in 'downtime', the time where the vessel is out of service for unscheduled maintenance and is unable to operate. In 2022 the vessel was out of operation for an estimated 91 hours, a significant increase from 2021 where an estimated 38 inoperable hours due to emergency maintenance was recorded (Figure 3).

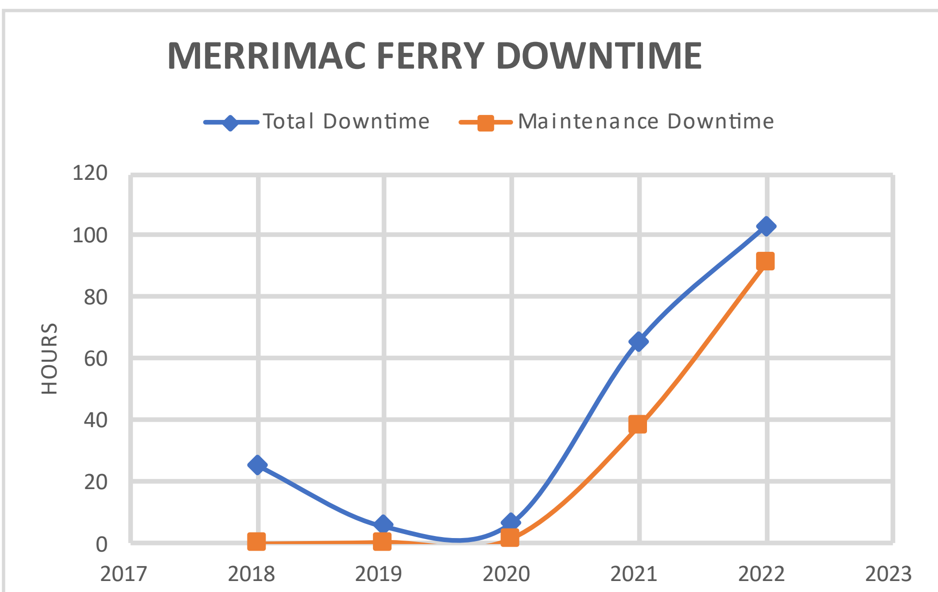



*Figure 3 Merrimac Ferry Downtime 2018-2022 (WisDOTColumbiaCo)*

## 3.2 Challenges in Maintaining an Aging Vessel

As the *Colsac III* ages, more maintenance becomes necessary. Sourcing replacement parts is increasingly difficult and costly due to their scarce availability.

## 3.3 Environmental Impacts

Operating with the current diesel engine powered propulsion system results in significant annual emissions. Application of alternative fuels/power sources could reduce or eliminate current emissions from the Merrimac Ferry crossing and align the service with the 2022 State of Wisconsin Clean Energy Plan as well as national goals for decarbonization in the transportation industry. Additionally, the current diesel engine results in fumes and noise which impact the experience of ferry users. The current project phase will explore vessel alternatives with more compliant diesel engines or battery electric propulsion systems.

## 3.4 Bicycle and Pedestrian Access

As a connection on U.S. Bike Route 30 and the Ice Age Trail, as well as serving as a recreational attraction itself, the ferry crossing is used by many bike-on and walk-on passengers. Potential improvements for bicycle and pedestrian service include a focus on loading and unloading access, ADA access on the vessel, and overall accessibility of the service.

## 3.5 Support Resiliency of the Regional Transportation Network

Maintenance or repairs needed during operations, especially cable replacement, requires this crossing to be unavailable. This results in a considerable detour for ferry users and reduces available transportation options, putting additional pressure on adjacent bridges and increases local traffic and sub-regional traffic impacts.

## 3.6 Provide Long-term, Sustainable, and Cost-effective Ferry Operations and Maintenance

Reducing operating costs and maintenance requirements, along with vessel emissions, will support the long-term sustainability of the historic Merrimac ferry crossing and maintain the economic and transportation benefits it provides to the region.

# 4. Summary

This State-owned ferry crossing has proven itself to be an important facility for the regional transportation network supporting all modes of travel, and WisDOT is committed to supporting its continued operation. The existing ferry service is becoming increasingly difficult to operate and maintain at the level necessary to meet the travel demands at this crossing. WisDOT is exploring both near- and long-term solutions to support reliable, sustainable Merrimac ferry service.

The first phase of this Study will provide near-term recommendations for the maintenance and operation of the existing vessel, as well as alternative concepts for design and operation of a future vessel. The next study phase, including assessment of future vessel alternatives, is anticipated to take several years to complete due to required environmental documentation. Ultimately, the goal of the Study is to select a preferred alternative result in implementation of a new vessel and associated terminal upgrades to support dependable and efficient as possible for the next 30 plus years.

# SYSTEM OPERATIONS AND MAINTENANCE ASSESSMENT MEMO

## Appendix B

# MEMO

*Date:* August 1, 2024

*To:* Wisconsin Department of Transportation

*From:* KPFF Consulting Engineers

*Subject:* Merrimac Ferry System Operations and Maintenance Memo

## 1 PURPOSE

Wisconsin Department of Transportation (WisDOT) is conducting the Merrimac Ferry Performance and Reliability Improvement Study to develop alternative concepts that improve service reliability, reduce vessel emissions, and meet the needs for all modes of travel for both the short- and long-term future of this ferry service. The Study includes the following tasks:

- Assess and document the existing conditions of the *Colsac III* and the Merrimac Ferry landings.
- Review the current operation and maintenance procedures of the ferry service.
- Analyze short and long-term alternative design solutions (projected to the design year 2050) for future ferry operations and provide detailed recommended alternatives for future environmental study.
- Provide recommendations for short-term improvements to the service, operations, and maintenance of the Merrimac Ferry.
- Document study findings to guide the department on future decisions.

This memo documents the existing conditions of the Merrimac Ferry, including service levels and ridership demand, conditions and operations of the landing facilities and vessel, and maintenance procedures and costs. Review of existing conditions is focused on establishing an understanding of the service to serve as a baseline for development of short- and long-term recommendations for operations and maintenance of the ferry landings and vessel, and assessment of vessel alternatives.

## 2 SERVICE AND RIDERSHIP OVERVIEW

The Merrimac Ferry traverses the Wisconsin River between Columbia and Sauk Counties, linking Wisconsin Highway 113 between Okee and Merrimac, as shown in Figure 1. The ferry transports vehicles, pedestrians, motorcycles, and bicycles on the approximately four-minute, half-mile crossing. The ferry has operated as a free crossing since 1933, when the state took over operations of the service.

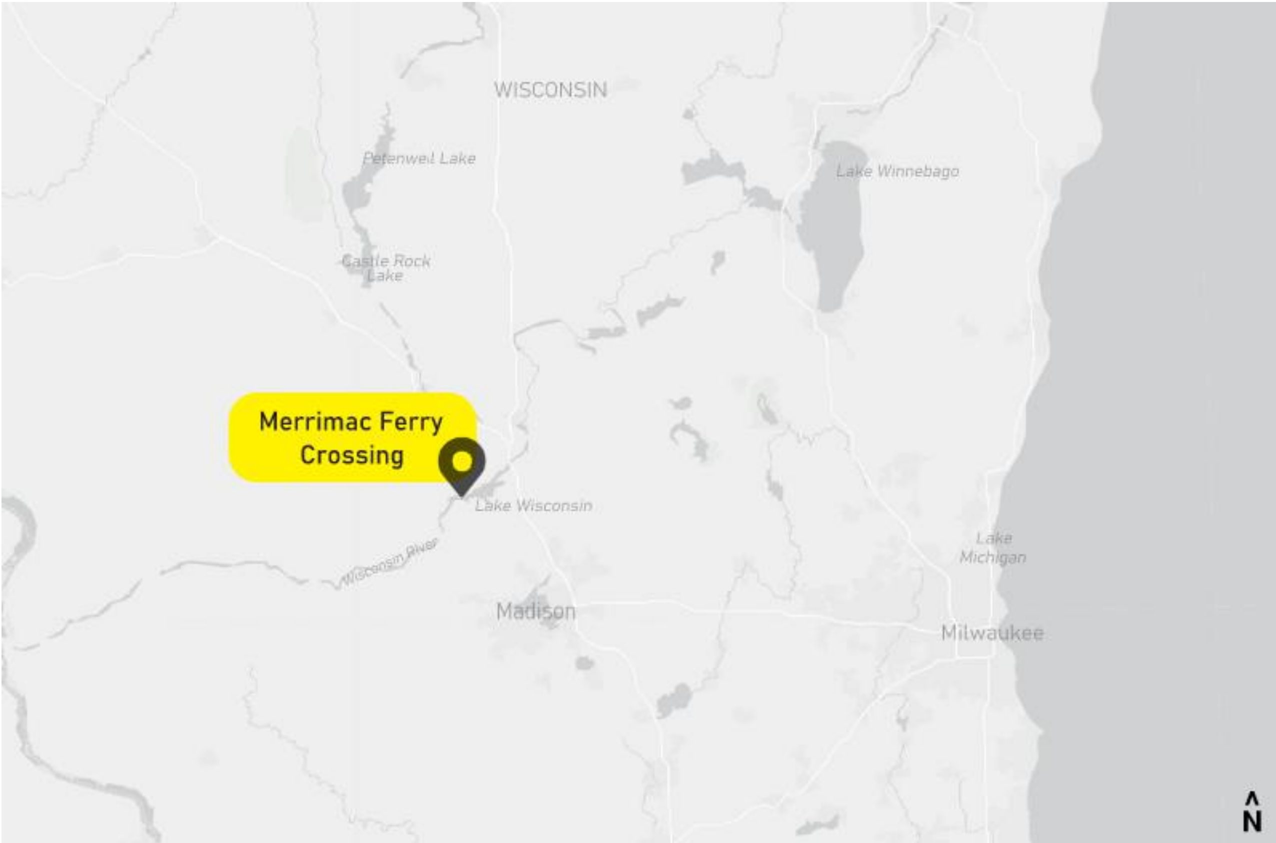



*Figure 1: Merrimac Ferry Crossing Location*

The current ferry carries up to 15 standard-size vehicles. Standard single-rear-axle trucks and tow-behind campers are permitted on board, depending on their maneuverability, with a maximum weight limit of 16 tons per vehicle. The ferry does not transport RVs but can accommodate a single school bus per crossing that is loaded midship to ensure proper weight distribution.

## 2.1 Schedule

The ferry operates seasonally, halting operations when the river freezes over and the vessel cannot cross. Columbia County staff use the winter shut down time to perform annual vessel maintenance On most years, the ferry is in operation between April and December. Table 1 identifies the earliest, latest and average start and end dates for the Merrimac Ferry service season between 2013 and 2022.

*Table 1: Average Operating Season: 2013-2022*

| Year | Date Opened | Date Closed |
|---|---|---|
| **Earliest** | March 09, 2017 | November 18, 2019 |
| **Latest** | April 20, 2020 | December 30, 2015 |
| **Average** | March 31 | December 10 |

When in service, the ferry operates 24 hours a day, continuously making trips back and forth across the Wisconsin River. Service is not provided on a fixed schedule, instead trips are made based on demand as vehicles and passengers queue at the landings. Breaks in service only occur when the vessel is out of service during scheduled fueling and maintenance and emergency repairs.

## 2.2 Ridership Demand

***Annual Ridership***

Over recent years, ridership on the crossing has been impacted by the COVID-19 pandemic, as well as variation in the number of annual crossings completed due to differences in operating season length and vessel time out of service due to maintenance and repairs. Ridership data collected over the past six years of operations (2018 to 2023) indicate an average of approximately 39,000 one-way crossings made by the Merrimac Ferry, carrying an average of over 220,000 total vehicles per year. Table 2 provides an annual summary of total annual one-way trips and vehicles carried.

***Table 2: 2018-2023 Ridership Data***

| Year | One-Way Trips Recorded | Total Vehicles Transported |
|---|---|---|
| **2018** | 46,613 | 239,783 |
| **2019** | 40,811 | 225,762 |
| **2020** | 35,213 | 206,775 |
| **2021** | 43,066 | 264,728 |
| **2022** | 33,853 | 164,894 |
| **2023** | 34,952 | 178,041 |

Assuming an estimated 246 annual operating days, the ferry completes an average of around 158 one-way trips per day, carrying a daily average of around 900 vehicles.

***Ridership by Month***

WisDOT started collecting ridership data by rider type (vehicle, bike, pedestrian) in 2023. Figures 2 through 4 summarize this data by month for vehicles, bikes, and pedestrians from May to December of 2023.

Vehicle traffic is generally higher from the opening of the seasonal service through the peak summer months, with a decline starting in September and reaching its lowest point towards the end of the operating season (Figure 2).

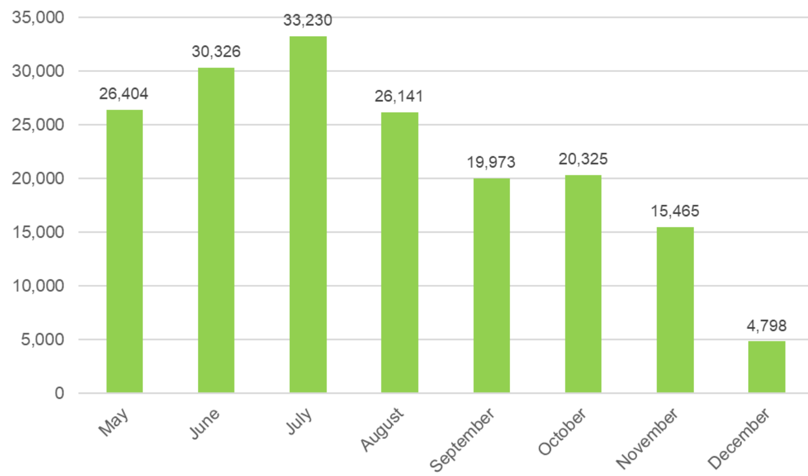



*Figure 1: 2023 Vehicle Traffic Recorded by Month*

Pedestrian traffic generally peaks during one or two summer months (Figure 3). Walk-on traffic sees a sharp decline in fall and winter months. Many pedestrian users take the ferry as the they travel along the Ice Age Trail.

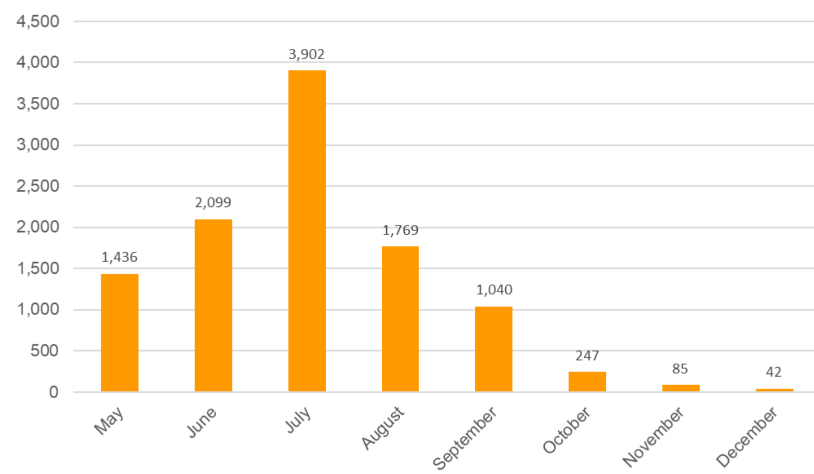



*Figure 3: 2023 Pedestrian Traffic Recorded by Month*

Bicycle traffic generally peaks during one or two summer months (Figure 4). The ferry serves as a link on Bike Route 30, making it a key feature of organized group rides that can attract hundreds of bicyclists.

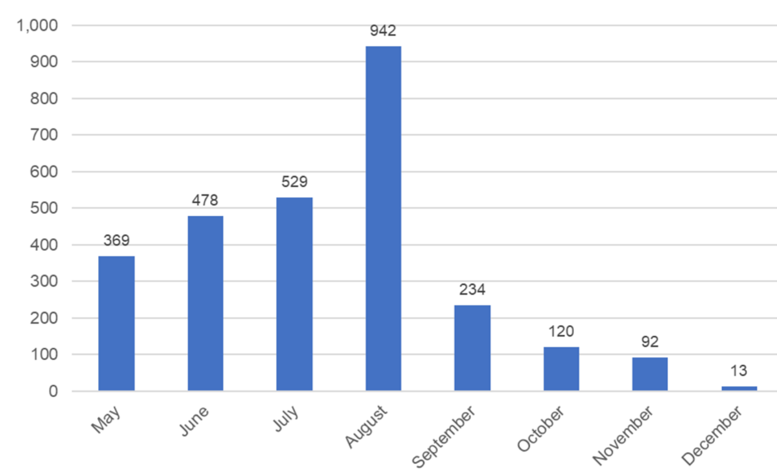



*Figure 4: 2023 Bicycle Traffic Recorded by Month*

***Average Daily and Hourly Demand***

As shown in Figure 5, daily ridership tends to be higher on weekend days than on weekdays, indicating that the ferry serves more recreational users than regular commuters.

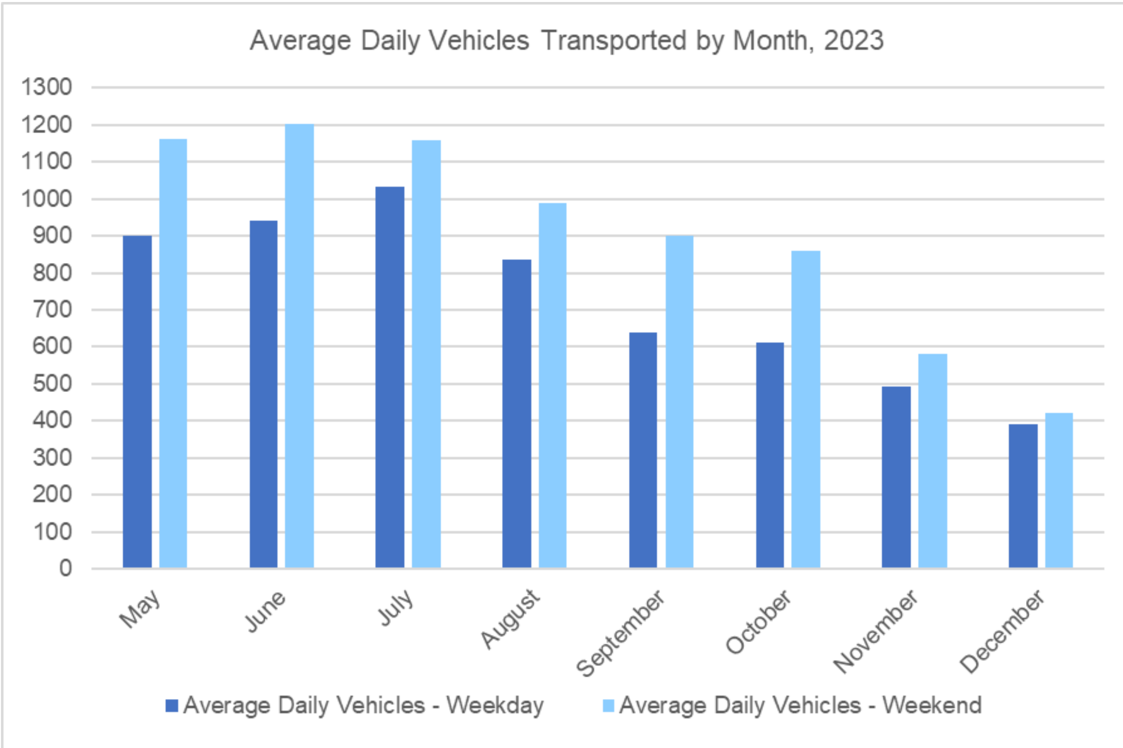



***Figure 5: 2023 Average Daily Vehicles Transported by Month, Weekdays and Weekends***

Because the ferry provides service 24 hours a day during the operating season, vehicle demand by hour varies significantly. As shown in Figure 6, between the hours of 11:00 PM and 5:00 AM, average hourly ridership is between 1 to 5 cars. Data highlighted in red indicate hours where the average vehicles transported is less than one third of vessel capacity.

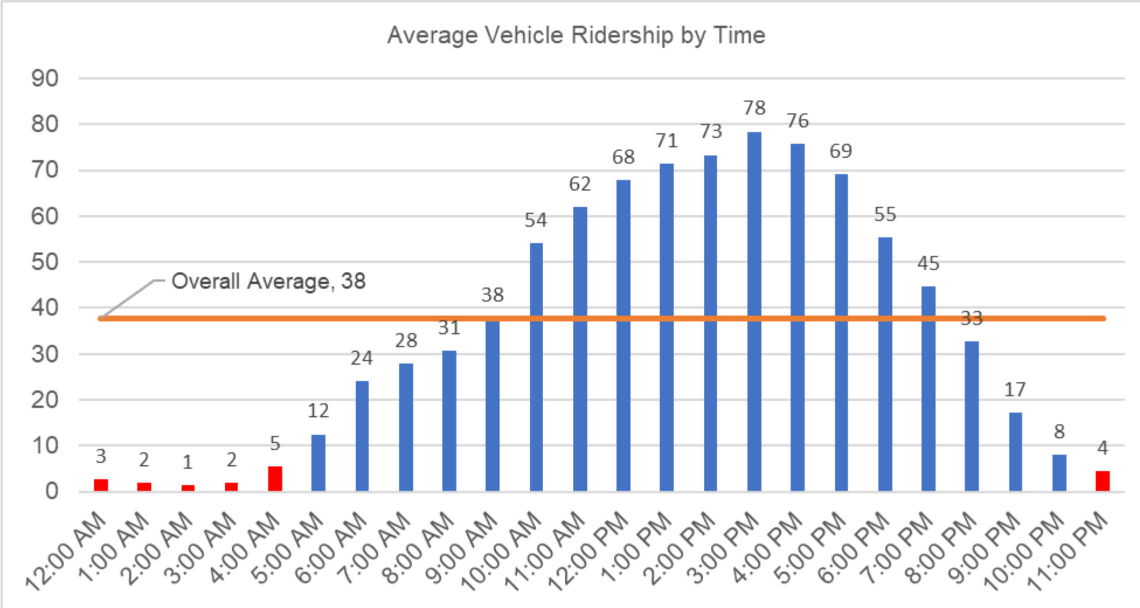



***Figure 6: 2023 7-Day Average Hourly Vehicle Ridership (May through December)***

### *Peak Demand Periods*

The current vessel capacity and service schedule generally meet or exceed current and historical ridership demand. Queue lines at the Merrimac ferry landings are reported by operators to occur infrequently. Waits are most likely to be seen during afternoons on busy holiday weekends including Memorial Day or the Fourth of July. Additionally, waits occasionally occur at the Merrimac landing between 7:00 AM to 8:00 AM as commuters travel toward Madison.

### *Forecast Demand*

A planning level traffic forecast was conducted by WisDOT staff to understand anticipated traffic growth on the crossing over a 25-year horizon. The forecast was based on traffic counts collected on the crossing and on WIS 113 on both sides of the crossing.

The forecast model estimates minimal growth in ridership on the Merrimac ferry crossing, with an estimated growth in vehicle demand between 0.6% and 1.1% over a 25-year period. Based on this forecast growth, the current vessel capacity appears to be adequate to meet vehicle demand through the planning horizon. Demand forecasted by this model will be confirmed during the official traffic forecasts that will be conducted as part of the future NEPA study for this effort.

# 3 FERRY OPERATIONS

The Merrimac Ferry and landing facilities are state-owned components of the state highway system. WisDOT is the agency responsible for funding ferry operations and planning and implementing future improvements. Service is delivered through a partnership with Columbia County, whose staff manage ferry operations and maintenance under contract with the state. Ferry staff include staff four operators and one mechanic.

Due to the operating environment of the crossing, the vessel is exempt from U.S. Coast Guard requirements for both vessel construction and maintenance, as well as crew licensing.

## 3.1 Vessel

The current vessel, the *Colsac III*, was built in 2003. The *Colsac III* is a double-ended diesel-hydraulic powered cable ferry. Table 3 outlines main vessel characteristics.

***Table 3: Summary of the Colsac III***

| | |
|---|---|
| **Year Built** | 2003 |
| **Overall Length** | 105 feet |
| **Beam (Width)** | 44 feet |
| **Vehicle Capacity** | 15 standard-size cars |
| **Vehicle Lanes** | 3 |
| **Lifejacket Capacity** | 180 adult & 50 children |

***Vessel Operations***

Each end of the vessel is equipped with three hydraulically operated ramps corresponding to the loading lanes on the ferry deck. At the ferry landing, queue lanes align with the lanes for loading onto the vessel. Vehicles are prompted to load by light signals operated by the vessel master, one for each lane, located aboard the vessel, as shown in Figure 7.

***Figure 7: Offloading the Colsac III***

The *Colsac III* operates with a single operator staffed per 12-hour shift, and no deckhand. The vessel operator controls both the loading lights and the bow ramps from the pilot house.

Traveler information for ferry users is provided via email alerts and on the [511 Wisconsin Travel Information] website. Information is also provided by signage on US Highway 12 that is updated real-time with ferry closure information and other travel notifications.

### *Existing Conditions*

A vessel inspection was performed by Elliott Bay Design Group engineers on June 19, 2024. Overall, the vessel structure was found to be in excellent condition.

Key concerns identified for the vessel include the following:

- *Hydraulic system:* Concerns over difficulty maintaining and securing parts for the existing system are noted, along with a recommendation to replace portions of propulsion hydraulic piping which is currently flexible hose with ferrous piping.
- *Drive cable:* Maintenance data indicates that drive cables have required replacement approximately every 8 weeks over recent years. Cable wear consistently occurs in a specific location, likely due to cable dragging on the bottom of the channel in one portion of the crossing, collecting grit which then wears on the cable as it is compressed by the sheaves.
- *Fire safety:* Concern regarding the current location of the fire suppression $CO_2$ cylinders within the engine compartment are noted. Relocation is recommended to improve accessibility for inspection and maintenance, as well as safety in case of an emergency. Additionally, improvements to the fire pump system could be made to improve priming efficiency.

The *Vessel Conditions Assessment Memo*, summarizing findings from a vessel inspection conducted in June 2024, is included as Attachment 1.

### *Fuel Use and Emissions*

In 2023, the ferry operation purchased 21,165 gallons of diesel fuel. Assuming this same amount of diesel was burned in that year, the ferry produced 215 metric tons of carbon dioxide, equivalent to the annual fuel use of approximately 51 typical cars.[1] Table 4 below provides a summary of estimated annual emissions, including key criteria air pollutants such as particulate matter and carbon monoxide.

***Table 4: Estimated Annual Emissions from Current Vessel***

| Emission | Value |
|---|---|
| Carbon Dioxide ($CO_2$) | 215 metric tons/year |
| Hydrocarbons and Nitrous Oxides ($HC+NO_x$) | 1,882 kg/year |
| Particulate Matter (PM) | 42 kg/year |
| Carbon Monoxide (CO) | 1,802 kg/year |

Additional detail on current fuel use and emissions are included in Attachment 2, *Merrimac Ferry Emissions Evaluation*.

[1] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

## 3.2 Ferry Landings

The ferry crossing travels between landings in the Village of Merrimac, Sauk County, to the north, and in Columbia County to the south. The landings, shown in Figures 8 and 9, are located more or less in the same places as they were when ferry service began in 1844.

Each ferry landing is a spur off the main road on each side of the Wisconsin River. The landings consist of three parallel holding lanes, below grade cable anchor pits for the drive cable and two guide cables, a steel sheet pile bulkhead, and a concrete and asphalt ramp which supports the ferry ramps during vehicle and passenger loading and unloading.

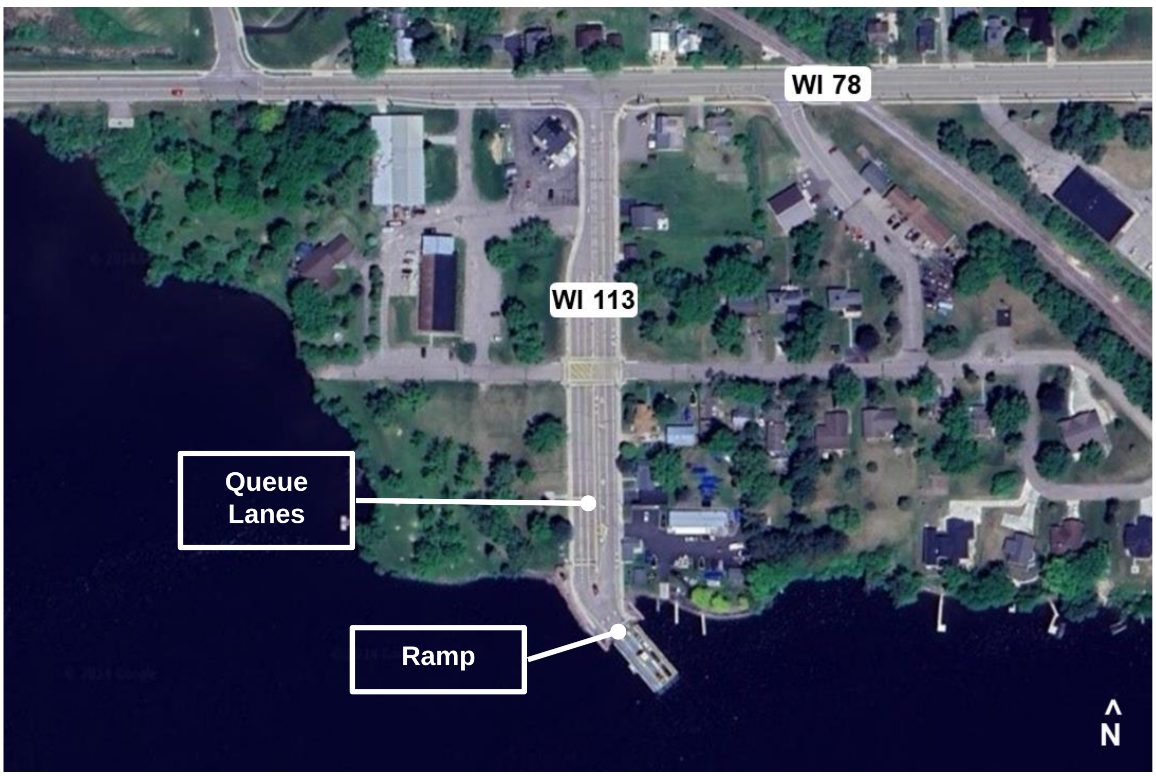



*Figure 8: North Landing*

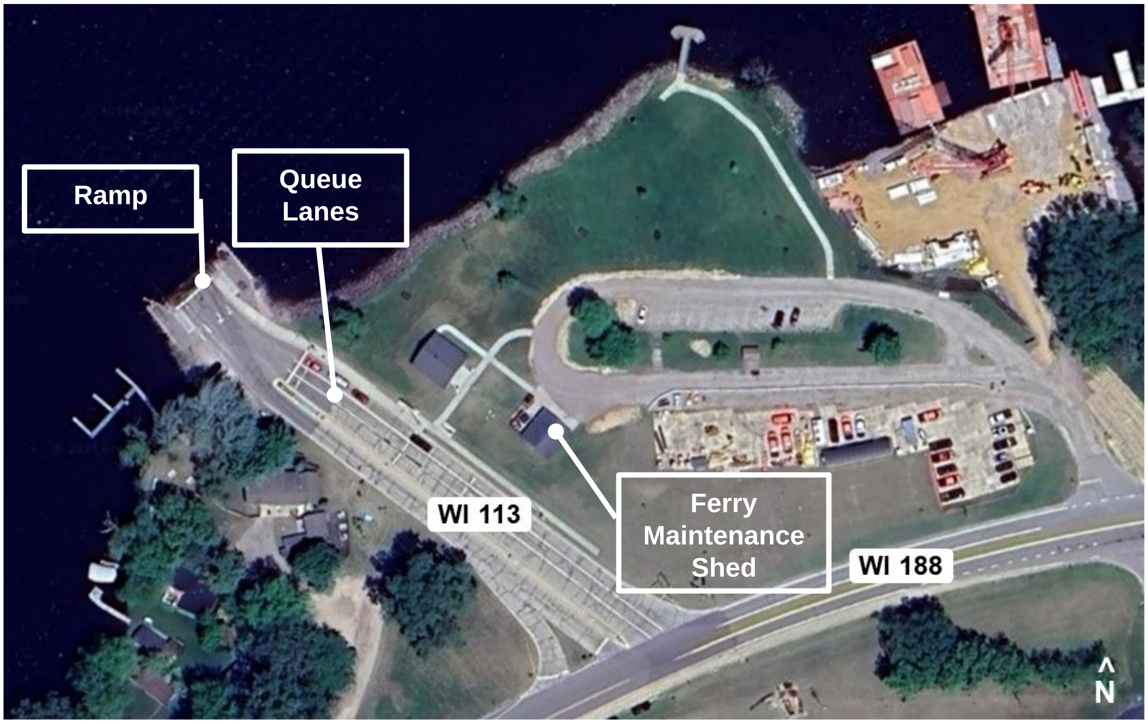



***Figure 9: South Landing***

***Existing Conditions***

A landing facility inspection was performed by KPFF Consulting Engineers on June 19, 2024. The assessment focused on shore ramps, upland paving condition, drive and guide cables, and supporting infrastructure.

The inspection identified minor repairs and improvements to be addressed over the short- and long-term. Existing conditions and recommendations are detailed in the *Ferry Landing Assessment Field Report*, included as Attachment 3.

## 3.3 Maintenance Practices

The Columbia County Highway Department manages vessel and shoreside maintenance, repairs, and parts purchasing and inventory. In addition to the single ferry maintenance staff, ferry operators are trained in vessel maintenance and perform maintenance during winter shutdowns.

Standard maintenance practices are outlined below.

- Daily maintenance: Staff perform maintenance based off a daily maintenance checklist
  - Visual check of vessel condition, including ramps, lights, engine rooms, drive cable slack, and safety equipment.
  - Grease and lube parts and equipment daily. Routine grease points on the vessel include the vehicle ramps, ramp cables, drive cable sheaves, and guide cable sheaves.
  - Clean up of any waste oil
  - Use water hose to wash boat and air intake screens

- Periodic maintenance
  - Drive cables: replaced when signs of wear are visible *(additional detail in the following section)*
  - Engine air filters: change (as needed)
  - Engine oil filter: change every 400 engine hours
  - Hydraulic oil and filters: replace every 3 months
  - Ramp cables: replace at the set intervals below based on frequency of use:
    - Lane 1: 3 times per year
    - Lane 2: 2 times per year
    - Lane 3: once per year
  - Vessel hull
    - Visual assessment by consultant (topside and hull interior): every 2 years
    - Visual assessment consultant with Non-Destructive Testing (NDT) (topside and hull interior): every 4 years
    - Underwater inspection every 8 years
- Annual maintenance completed during winter shut down
  - Hull and superstructure heavy-duty cleaning, maintenance, and repairs
  - Removal and replacement of seals on pumps, brake, and drive motor
- Replaced as needed
  - Flexible hydraulic system hoses
    - Guide cables (typically every 3 to 4 years)
    - Engine overhaul (engines are replaced after 18,000 to 20,000 operating hours)

***Cable Inspection and Replacement***

The Merrimac Ferry operates with two guide cables and one drive cable. Guide cables are replaced every three to four years; however, in recent years, drive cable replacement has occurred as frequently as every eight weeks, compared to a frequency of every 15 weeks that was previously typical.

Inspection and replacement of the vessel drive cable has been identified as a key focus for vessel maintenance staff. Cable inspections are completed based on a schedule developed by Columbia County and the department, as outlined below:

- The first cable inspection is completed three to four weeks after installation of a new cable.
- After a total of five to six weeks, or once flat spots and cracks on the crown wires are visible, the cable is inspected weekly.

Inspection of the drive cable consists of visually checking for flat spots and cracks, as shown in Figure 10. The cable is replaced once 3 to 5 cracks per foot or abnormal stretching is visible. These inspections are done by removing the two inspection covers by the wheelhouse.

***Figure 10: Example of cracks on the crown wired are circled in red and flat spots are circled in blue***

## 3.4 Operations and Maintenance Costs

Yearly operations and maintenance costs are collected by Colombia County and categorized as follows:

- Labor: The wage and fringe costs for employing vessel operators and mechanics
- Material: The physical materials that are required for the upkeep and maintenance and continued operations of the ferry. These costs include fuel, technical representatives for engine/auxiliary systems service, and other miscellaneous costs that are directly tied to vessel operations.
- Machine: The cost of maintaining the shoreside equipment (crane and trucks to support vessel cable change-out, and other miscellaneous needs).
- Admin: The cost of administrative staff and program management within the county to support ferry service operations.

Historical cost data shows a relatively steady, modest increase in labor and materials costs for vessel operations, as shown in Figure 11.

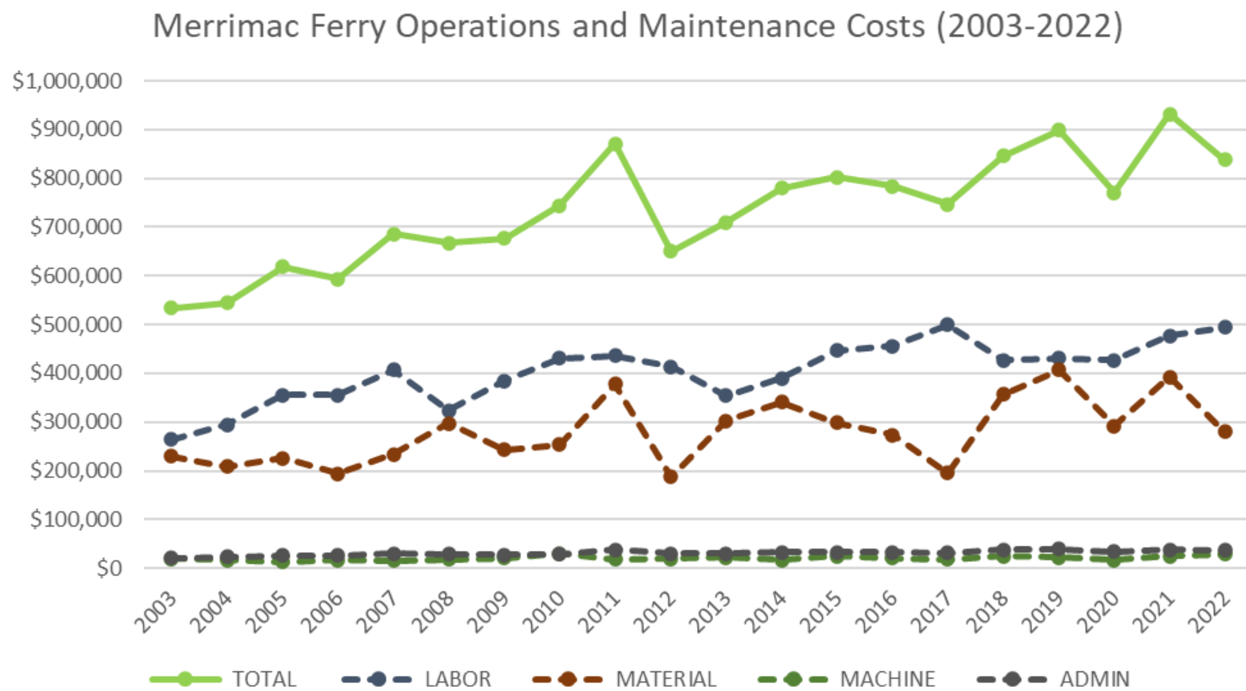



***Figure 11: Historical Operating Costs***[2]

[2] Historical operating costs not adjusted for inflation.

# Attachment 1

## Vessel Inspection Report

# COLSAC III

## VESSEL INSPECTION REPORT

Prepared for: KPFF | Seattle, WA

Ref: 23112-070-0

Rev. -

November 23, 2024

## PREPARED BY

ELLIOTT BAY DESIGN GROUP
PO BOX 45790
SEATTLE, WA 98145

## REVISIONS

| REV | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| - | Initial Release | 11/23/24 | |

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# 1. PURPOSE

Wisconsin Department of Transportation (WisDOT) has hired KPFF and Elliott Bay Design Group (EBDG) to evaluate the existing condition of the COLSAC III, a 105 ft x 44 ft x 5 ft 8 in car and passenger cable ferry. EBDG was onsite to inspect the COLSAC III on Wednesday, June 19$^{th}$. This report serves to summarize the findings of EBDG engineers.

# 2. PROCEDURE

EBDG Engineers were onsite for the vessel inspection during a typical Wednesday refueling operation. Maintenance personnel were onsite to provide access to all hold spaces, engine compartments, cable anchoring vaults, and sheave compartments.

In addition to refueling the vessel, the maintenance team replaced ramp cables on Lane 1 and performed a cable inspection from the upper deck access plates. These operations gave EBDG additional insight into the vessel condition.

As with reference [1], this report will be divided into mechanical and structural inspection results. This assessment will provide commentary on the existing condition and make immediate maintenance and improvement recommendations. Any major modifications or alternative designs will be discussed in a future study.

While the COLSAC III is not a USCG inspected vessel, this report will refer to regulations typically applied to a vessel of this size and capacity; that is 46 CFR Subchapter T – Small Passenger Vessels (Under 100 Gross Tons).

# 3. MACHINERY SYSTEMS ASSESSMENT

## 3.1 ENGINES

The installed engines are well maintained. The crew maintains an approximate 400-hour oil change regimen which exceeds the requirements of the engine manufacturer. The engines are replaced every 18,000 to 20,000 hours and an additional engine is on standby for installation should an installed engine need replaced. The operator's control panel is equipped with the correct instrumentation to indicate the status of the engines.

## 3.2 ENGINE AUXILLIARIES

### 3.2.1 COOLING

The engines are cooled with freshwater cooling loops and integral keel coolers. Each engine is equipped with an appropriately sized expansion tank. There are no known issues with this system. The details of the keel cooler(s) are unclear from reference [2], but the next underwater inspection should include images and/or video of the keel cooler(s) to verify the condition.

### 3.2.2 EXHAUST

Each engine is equipped with an independent exhaust system complete with silencers and insulation. While the engine compartments are tight, all exhaust piping could be observed during inspection. The lagging did not exhibit any deterioration and no exhaust leaks were observed while the vessel was in operation. The exhaust pipes are equipped with rainhats to prevent rainwater from draining back to the engines. There are no known issues with this system.

#### 3.2.3 FUEL SYSTEM

The fuel system is appropriate for the vessel. The fuel tanks are located above main deck and are capable of being cross connected such that the operating engine has access to the complete fuel storage capacity. Each fuel tank is equipped with a fill and a vent.

Per reference [2], sheet 21, the fuel tanks are equipped with remotely operable supply valves; however, at the time of inspection these remote shut offs were not located. The fuel shut off valves would be required per 46 CFR 182.455(b)(4) and would function as a secondary means for stopping the engines under any operating condition per 46 CFR 182.200(b).

#### 3.2.4 VENTILATION

Each engine room has an intake louver near the engine and an exhaust fan and louver in the space above the engine. The air flow is assumed appropriate for the engines as there are no known engine performance issues. The upper louver is equipped with a back draft damper to close when the exhaust fan is not operating and prevents ingress of water. The fans can be shut down from the pilothouse.

Per 46 CFR 182.465(h), provision must be made for closing supply and exhaust openings for ventilation of spaces containing diesel machinery which are protected by a fixed gas extinguishing system. It does not appear that the supply and exhaust louvers of the engine room can be closed on this vessel. This issue was also noted in 2005, reference [3].

### 3.3 HYDRAULIC SYSTEMS

The hydraulic systems are problematic for the owner and maintenance team. The propulsion hydraulic system was first to fail when the vessel was initially constructed and required significant modification to be operable, reference [3]. While the modifications to the system in 2003 have provided for a clean, nearly leak free operation for 20 plus years, the installed equipment is aging. The maintenance team reports that acquiring replacement parts is difficult and that the major propulsion equipment is not "off the shelf." The installed equipment is no longer supported by the manufacturers and the design of custom equipment is not well documented.

The propulsion hydraulics and gate operating hydraulics operate from a combined reservoir located in the space above the South engine compartment. As noted in reference [3], typical marine design is to separate main propulsion systems from auxiliary systems as much as possible. Separating these systems is impractical at present, but any major overhaul or new design should consider separation of vital and auxiliary systems as a design requirement.

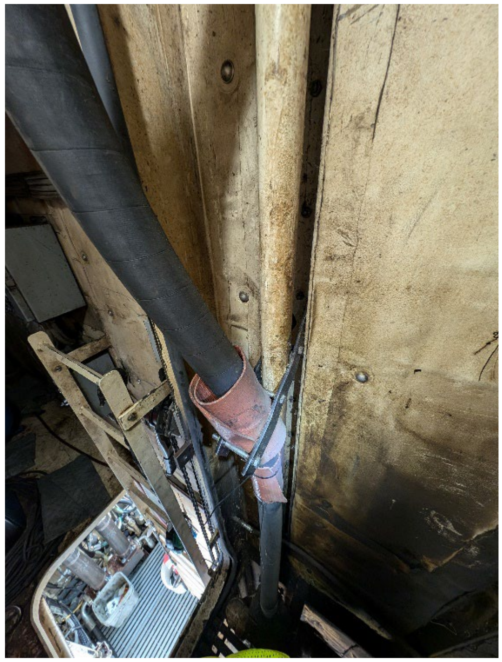


*Figure 1: Hydraulic Flex Hose in North Engine Room*

A significant portion of the propulsion hydraulic piping has been replaced with flexible hose. The propulsion hydraulic system is a vital piping system on the vessel as defined by 46 CFR 182.710(a)(6) and as such should be primarily composed of ferrous materials expect as permitted by 46 CFR 182.720. Flexible nonmetallic hose may be used in fluid power systems, but it is limited to a length of 30 inches and is for the purpose of flexibility only per 46 CFR 182.720(e)(3)(v). Ferrous piping, such as carbon steel or stainless steel provides better protection against fire and a rigid conduit for hydraulic oil.

## 3.4 PROPULSION SHEAVES AND CABLE ARRANGEMENT

### 3.4.1 CABLE LIFE

WisDOT has expressed a primary concern for the vessel operation is the reduced drive cable life. Guide cable life is currently satisfactory, with replacements lasting 3-4 years. Currently, a drive cable only lasts from approximately eight weeks whereas previously cables lasted up to 15 weeks. Sourcing replacement cables of the same material and construction process has proven difficult even when purchasing to the same specification. The maintenance team has experimented with a variety of different materials to improve cable life.

The cable wear is not uniform; there is a section of 50 to 100 feet of cable just beyond the center of the crossing when traveling North failing faster and driving premature cable replacement. During the vessel inspection, the crew opened the access hatch above the sheaves to inspect the cable, Figure 2. EBDG observed an audible change in the cable operation during this portion of the route. Because the cable is wearing in a specific location, it is surmised that cable wear is not due to misalignment of the sheaves or dynamic loading.

*Figure 2: Routine Cable Inspection*

EBDG proposes that sand or grit in this section of cable is compressed between the cable and the sheaves. The cable is a softer material than the sheaves, thus the cable is failing. The addition of a cable wash system as the cable enters the vessel may reduce the collection of grit that is causing the cable to fail. The drive cable coffin may offer space for the addition of such a system, Figure 3.

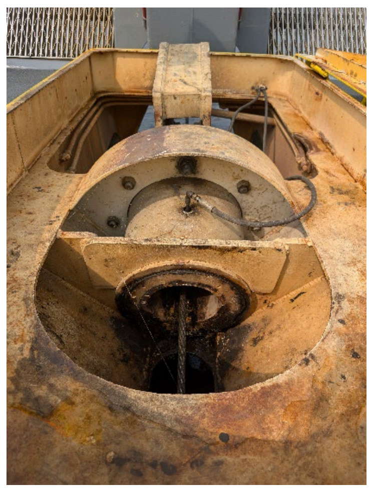


*Figure 3: North Drive Cable Coffin*

### 3.4.2 SHEAVES AND BEARINGS

The sheaves are not stock items and must be custom manufactured with additional hardening in the cable groove. The manufacturing details of the sheaves was a source of confusion when the vessel was first launched, reference [3]. Sourcing replacement sheaves has been difficult for the maintenance team; the go-to manufacturer has simply stopped responding to requests for new components. The maintenance team has located a new manufacturer closer to the vessel operation, but a different construction process is used. The South guide sheeve is experimental and should be observed for wear and life as compared to the other three sheaves.

*Figure 4: Sheaves, Older Construction Top, Newer Construction Below*

The sheave bearings appear well maintained and lubricated. The bearing on the South guide sheeve is a newer style and the maintenance team reports that it is significantly easier to install and maintain. This newer bearing style should be observed for possible use on the other sheaves.

## 3.5 BILGE SYSTEM

The bilge system is simple and typical of catamaran vessel with independent, automatic, lift style pumps in each compartment. The pilothouse has a dedicated panel to inform the operator if a bilge pump is operating and thus alert the operator to a leak in the given compartment. There are no known issues with this system.

During the inspection, EBDG tested a few bilge pumps by lifting the associated floats to confirm the pumps were operational. This does not, however, demonstrate that the pump will dewater the space. The owner should confirm that the overboard discharge pipes are clear and test the pumps' operation. If this vessel was a USCG inspected vessel, the owner would need to demonstrate this functionality at each inspection per 46 CFR 176.804(h).

## 3.6 FIRE SAFETY

As was discussed in the independent review in 2005, [3], the fire safety systems remain a top concern for the vessel.

### 3.6.1 $CO_2$ SYSTEM

The engine compartments are equipped with an automatic fixed fire suppression system comprised of two $CO_2$ cylinders located in the space above the North engine compartment and a nozzle in each engine compartment. The system should automatically activate and shut down ventilation and engines in the presence of a fire. The design of such systems is typically governed by 46 CFR 181.410.

Automatic operation of this system is expected as the cylinders are stored within the protected space and the protected space is a small unoccupied space. The automatic response was not confirmed during this vessel inspection.

Per 46 CFR 181.410(c)(2)(ii) the system is required to have secondary manual controls to discharge the system. These controls are expected to be outside of the space protected and not located in a space made inaccessible in the event of a fire in the space protected. The location of the manual system release is on the $CO_2$ cylinders within the space protected, potentially above the source of a fire.


*Figure 5: Manual Activation Placard, $CO_2$ Cylinders Above North Engine*

As previously mentioned, in the engine ventilation discussion, a means to secure the supply and exhaust air to a space containing diesel machinery and protected by a fixed fire suppression system is expected.

The storage cylinders should be accessible, capable of easy removal, and it should be possible to weigh the cylinders in place per 46 CFR 181.410(c)(5). The location of the cylinders just above the door to the engine compartment is appropriate for inspection, but the maintenance and monitoring of the system capacity is unknown.

### 3.6.2 FIREMAIN

The fire pump and associated piping are located on the starboard side of the vessel. The system is simple and will provide the required coverage when equipped with hoses. The pump is capable of local start and remote start from the pilothouse.

*Figure 6: Fire Pump*

Per the design drawings and 46 CFR 181.320(a), a fire hose with nozzle should be attached to each fire hydrant station at all times.

During the vessel inspection, after maintenance was complete, the fire pump was used to wash down the deck. EBDG observed that while the pump is a self-priming pump, getting the pump primed was not a simple task. The pump suction may be ingesting air while the vessel is in motion and the suction elevation above the water line can also cause issues. The non-self-priming installation renders the remote pump start ineffective. If considering modifications to the vessel, lowering that fire pump into the hold, below the waterline should produce more effective pump priming.

### 3.7 VESSEL CONTROLS

The vessel controls are simple and appropriate for a single operator. The necessary engine controls, gate controls, engine monitoring, and ventilation controls are located on either side of the pilothouse. The side in control is selectable with a knob. The only comment of note on the vessel controls was provided by the operator during the vessel inspection. The controls are mirrored between ends such that vessel propulsion is on the right side and gate operation is on the left side. When operating the gates on the North end of the route, the division of the pilothouse window can obstruct the operators view of lane 3.

## 4. VESSEL STRUCTURAL ASSESSMENT

Overall, the vessel structure is in excellent condition. EBDG inspected the interior of all hull compartments, accessible external structure, and accessible sections of the superstructure. Coatings are almost entirely intact so corrosion was quite minimal. Figure 7 shows an image of the end rake compartment.

In addition, the highly loaded sections of the vehicle deck and supporting structure (in way of truck loading) were closely inspected for fatigue cracking. None was evident, which shows that the deck loading is well within the capacity of the structure.

*Figure 7: General Hull Structure Condition Image, North End Rake*

## 4.1 HULL STRUCTURE

Hull structure, structural details, and welds were inspected throughout the five main watertight compartments of the hull. The structural detailing was well executed at the time of construction and reflects common commercial marine best practices, with bracketing, connections, stiffening, and plate thicknesses as expected. The weld quality was average for commercial marine throughout the hull. No incipient cracking in welds or structure was observed that would require repair or monitoring.

## 4.2 SUPERSTUCTURE

The majority of internal superstructure was concealed by insulation or linings. However, the portions that were observed were in good condition.

## 4.3 RAMP AND DECK STRUCTURE

The crew related that the ramp, ramp mechanism, and deck structure have provided reliable service. The crew adequately maintain the mechanical hinges and components of the ramps including regular greasing. This is important for operations and these structures are adequately sized to the loads imposed.

The primary wear occurs on the underside of the ramps at the contact point to the landings. Figure 8 shows the sacrificial flat bars that have been added to the wear areas. Per discussion with the crew, they are trialing an abrasion resistant alloy for the wear bars which EBDG endorses.

*Figure 8: Ramp Structure*

## 4.4 COATINGS AND CORROSION

The COLSAC III enjoys the relatively benign freshwater environment of Lake Wisconsin. The fresh water and cool average annual temperatures combine to result in low risk of corrosion provided the coating systems are maintained. The overall coating condition is excellent with no observed structural wastage/corrosion.

### 4.4.1 INTERIOR

Interior hull coatings were renewed in 2019 per discussion with the crew. Generally, this recoating is intact and well applied. There are sections on the bottom of the cross-deck structure where the renewed coating has failed in sheets. This failure appeared to be due to hydraulic oil contamination. The original hull coating was intact under the renewed coating. Figure 9 shows an example of this failure. As the original coating remains intact, there is no immediate need to recoat, however this area could be scraped, cleaned, and recoated for equivalent protection as the intact hull coating areas.

*Figure 9: Coating Failure in Cross Deck Structure, North End*

The North end rake had an approximately 12-inch diameter section of bottom shell plate that was stove in, likely due to over winching the vessel and contact with the shore side cable vault. On this surface the coating including primer had cracked off the underlying plate due to the magnitude of the deformation. Recommend prepping, priming, and top coating this small area to match the surrounding plate.

Figure 10 shows this area recommended for recoating.

*Figure 10: North End Bottom Shell Deformation (re-paint area)*

### 4.4.2 EXTERIOR

The exterior of the hull (above the waterline) and the superstructure were reportedly recoated during the 2019 maintenance period. These coatings are also in good condition, including the vehicle deck coating in way of the traffic loadings.

*Figure 11: Exterior Coatings Image*

# 5. REFERENCES

[1] Elliott Bay Design Group, "23112-01M COLSAC III Vessel Inspection Plan," 5/31/2024.

[2] Timothy Grual Marine Design, "Project 00076 Wisconsin River Ferry Crossing at Merrimac Drawing Package," 2003.

[3] Elliott Bay Design Group, "COLSAC III Independent Review, 03131-1-0765," 4/1/2005.

# APPENDIX

Recommended Maintenance and Inspection

## MAINTENANCE RECOMMENDATIONS

As discussed in the preceding inspection report, there are maintenance activities which WisDOT can do to improve and maintain the COLSAC III. Below is a condensed list of these items:

1. Cable Wash – a cable wash system should be installed at each end of the vessel to rinse sand and grit from the cable to the extent possible before passing over cable sheaves and drive wheels.
2. Fuel System – Remote shut off valves in the fuel system could not be located.
3. Engine Room Ventilation – Provision should be made for closing supply and exhaust openings for ventilation of spaces containing diesel machinery which are protected by a fixed gas extinguishing system.
4. Fire Pump Priming – The addition of a foot valve to the suction line of the fire pump should be considered to improve the priming time of the fire pump.
5. Interior Coatings – Various sections of paint internal to the hull have failed. It is recommended that the coating in these areas be renewed.
6. Keel Coolers – There are no known issues with this system; however, during the next underwater inspection and every underwater inspection thereafter, attention should be paid to the area where the cooling channels are installed. Images and/or video should be used to capture the condition of this area.
7. Vessel Hydraulics – hydraulic hose lengths should not exceed 30 inches. Ferrous piping should be considered for replacement of existing hose lengths that are greater than 30 inches on the vessel.

## INSPECTION RECOMMENDATIONS

While the COLSAC III is not a USCG inspected vessel, this report referred to regulations typically applied to a vessel of this size and capacity; that is 46 CFR Subchapter T – Small Passenger Vessels (Under 100 Gross Tons).

The following document are examples of typical annual inspections performed by the USCG for Small Passenger Vessels:

- SMALL PASSENGER VESSEL T-BOAT CHECKLIST (CVC-FM-021(1))
  https://www.dco.uscg.mil/Portals/9/CVC-FM-021%281%29_1.pdf
- T-BOAT INSPECTION BOOK Inspector Reference Guide (CVC-FM-840T(1))
  https://www.dco.uscg.mil/Portals/9/CVC-FM-840T%281%29_1.pdf

A copy of The Small Passenger Vessel T-Boat Checklist is provided with this appendix.

Not all items in these lists are applicable to the COLSAC III. As future scope, EBDG can assist WisDOT in creating a checklist that is directly applicable to the COLSAC III or any future vessel operated by WisDOT.

# SMALL PASSENGER VESSEL T-BOAT CHECKLIST

•☐In-Service •/♦☐ Reduced Annual ☐Annual ☐Expanded Annual ☐COI

Vessel Name:________________ VIN:______________ MISLE Activity:____________ Date: ______________

Location: ______________________ User Fee: Y☐ N☐ Inspector(s):______________________________

Vessel Rep:____________ ☐Owner/☐Operator Phone:___________ Email: ____________________________

**Build Date:**________ **Max PAX:**______ **O/N Accom:** ________ Hull: ☐FRP ☐Wood ☐Alum ☐Steel // ☐Sail ☐Hi-Speed ☐Amphib

• Annual Focus Area 2021

☐ Accommodations (Crew & Pax).......................177.800/09198
☐ Overnight accommodation spaces..................183.550/07199
  Independent modular smoke detection w/alarm unit
☐ Operation of detectors/alarm units..................181.450/07199
☐ Li-Ion Battery Storage.....................................176.830/09298
☐ Li-Ion Battery Charging...................................176.806/09209
☐ Human Factors................................................176.800/99101
  -What are crew responsibilities for safe operations of vessel?
  -What are your procedures if you receive an alarm?
  -For O/N ops, who conducts rounds? How often?
  -What are your procedures for inclement weather?

### Certificates & Documents

♦☐Certificate of Inspection (COI)................176.302 / CG001
♦☐Stability letter..........................................178.210 / 01326
•☐Merchant Mariner Credentials (MMCs)...15.515 / 01201
☐Drug & alcohol program (Swabs)............185.212 / 18299
♦☐Maintenance & service records.............176.810 / 07199
♦☐Muster & emergency instructions..........185.510 / 04108
♦☐Certificate of Documentation (COD) (>5 NT) or
☐Commercial State Registration...............67.313 / CG003
☐FCC Permit, Certs & Licenses...47-80.13&.1001 / 01104

### Logs & Manuals

•☐Vessel's Log..............................................185.728 / 01305
  ♦*EPIRB Test (>3nm)..........................................185.728 / 11199*
  ♦*Drills (New mbrs & every 3 months).............185.520 / CG004*
  ♦*Maintenance of survival craft.......................185.702 / 11199*
☐Waste/Garbage Mgmt Plan....................184.702 / 14503
  *(Route >3nm, Domestic)*
☐Crew/Pax list (O/C & ON/ports)..............185.502 / 10127
☐Voyage plan (O/C or ON)........................185.503 / 10127
☐Passenger count.......................................185.504 / 10127
•☐Safety orientation...................................185.506 / 10127

### Bridge/Navigation Systems

♦☐Internal comms & control systems.........184.602 / 04116
☐Radar(s) (>49 pax, O/LC/GL)...................184.404 / 10103
☐Magnetic compass...................................184.402 / 10105
☐GPS(O)......................................................184.410 / 10115
☐Radio telephone (>20m, PDV)................184.502 / 05103
☐Nav lights & dayshapes..........................33-83.20 / 10109
☐Sound signaling devices........................33-83.33 / 10109
☐Nav pubs, charts.......................................184.420 / 10111
☐Steering system controls.........................182.610 / 13199
♦☐Gauges at Helm: ................................182.410(b) / 08199
  *RPM (not Old T), Temp, Oil Press*
  *Bilge high level alarms (>26')*
  *Automatic bilge pump indicator*
  *Vapor detection system (Gasoline)*
  *Propulsion engine gauges*
♦☐Distress signals.........................................180.68 / 11116
  *Marked, W/T(O/C/LC – 6/6)(LBS/R – 3/3)*

### General Health & Safety

☐Top decks marked max Pax.....................185.602 / 01310
•☐Accommodations (Crew & Pax).............177.800 / 09198
  *Location & Number*
  *74" x 24" x 24"*
  *Escape route access*
  • *General alarm*
  • *Independent smoke detection/alarm unit (ON)*
☐Structural Fire Protection........................177.410 / 07101
  *Noncombustible trim/Fire-resistant furnishings*
•☐Means of escape (Accom/E/R)................177.500 / 07120
  *2 widely separated/ ≥32"*
  • *Emergency lighting*
  •*"EMERGENCY EXIT, KEEP CLEAR" - 2" Letters*
☐Mess deck and galley spaces..................184.220 / 09124
  *Cooking fuel restrictions – no gas/open flame*
  *Cooking equipment – Grab rails, locking*
  *LPG/LNG-Remote shutoff valve*
  *Structural fire protection (B-15)*
  *Grease extraction hood (UL710)*
☐First aid kit..................................................184.710 / 09112
☐Portable lights...........................................183.430 / 04103
  ≥2 onboard; op station & E/R access
☐No unsafe conditions/practices exist.....176.830 / 09298
☐Paint locker................................................183.530 / 07109
  *Enclosed space*
  *Steel or equivalent*
  *Class 1 Div 1 or intrinsically safe*
  *Means to secure ventilation*

### Lifesaving Equipment

♦☐EPIRB *(O or ≥ 3NM GL)*...............................180.64 / 05111
♦☐Life jackets..................................................180.71 / 11118
  *# Adults # Child*
  *Lights (O/C/GL); Placard*
♦☐Ring Life Buoys...........................................180.70 / 11117
  *# w/light(s); # w/ 60' line(s)*
♦☐Liferaft & IBA.............................................180.200 / 11108
  *Quantity; Stowage*
♦☐Lifefloat & BA............................................180.200 / 11108
  *Quantity; Stowage*
♦☐Rescue boat/platform..............................180.210 / 11130
♦☐Launching appliance(s)...........................176.808 / 11112

# SMALL PASSENGER VESSEL T-BOAT CHECKLIST

### Firefighting Systems

♦☐Fire main & pump (≥65 ft & ≤49 pax).....181.300 / 07110
☐Fire stations...............................................181.310 / 07110
♦☐Fire Buckets ≥3 - 2.5 gal..........................181.610 / 07110
*Lanyard; `FIRE BUCKET'*
*Hand operated fire pump ≥5 gpm (Old T)*
♦☐Portable Fire Extinguishers.....................181.500 / 07110
♦☐Semi-portable firefighting.......................181.500 / 07110
☐Fire axe(s)(>65').......................................181.600 / 07110
♦☐Fixed fire extinguishing systems............181.400 / 07109
♦☐Fire & smoke detection systems............177.410 / 07106
☐Structural fire protection (FRP)..............177.410 / 07101

### Machinery & Aux Systems

☐Steering gear............................................176.814 / 02105
- *Emergency steering unless duplicate controls/multi-screw propulsion*

☐Fuel oil service system.............................182.435 / 13199
- ♦ *Shutoff valves (tank connection, ≤ 12" w/in space & shielded) & engine end of fuel line*
*Suitable metal marine type strainer*
*Nonmetallic flexible hoses and fittings*
*Double hose clamps, lengths permitted, approved standards*

☐Main propulsion system(s)......................182.200 / 13101
*At least 2 means of stopping the engine*
*Protective covers/guards*
*System hull penetrations*
*Keel coolers w/shutoff valve (external)*
*Operational test*
*Gauges: Engine RPM, Jacket water temp, LO pressure*
☐Unfired pressure vessels (UPVs).............61.10-5 / 13199
*Data plate(s)*
*External (5 yrs)/Internal (5 yrs when accessible)*
*Pressure gauges/Relief device (2/5, <3yrs; <10%±Limit)*
☐Potable water system.............................54.01-15 / 09130
♦☐Bilge system.............................................182.520 / 13104
*Portable hand bilge (if required)*
*Visual & audible alarm (>26')*
*Operational test*
☐Exhaust system (wet & dry)....................182.425 / 13199
*Dry Exhaust pipes are suitably insulated*
*Wet Exhaust insulation or water jacketed prior to point of cooling; suitable strainer*
☐Auxiliary Boiler(s)......................................176.812 / 13199

### Electrical Systems

☐Switchboard & distribution panel...........183.330 / 02108
*Dry, ventilated, enclosed, drip shield*
☐Main service generator/prime mover....183.310 / 13102
*2 sources of power for vital systems*
*≥ 50 Volts, voltmeter & ammeter (AC)*
*Overcurrent device*
*Reverse Power Relay (parallel ops)*
*Protective Cover/Guards*
☐Lighting systems......................................183.410 / 09203
*Guard/hi-strength material*
*Emergency lighting operational test*
☐Battery installation...................................183.352 / 02108
*Properly installed/secured/located*
*Large installations in a room/box - Class I, Div I space*
*Ammeter connected in the charging circuit*
☐Electrical cable & fixtures........................183.340 / 02108
*Supports (≤24")*
*No sharp radius or bends*
☐Hazardous area components.................183.530 / 02108
*Gasoline or fuels w/flashpoint of ≤ 110̊F*
*Paint lockers*

### Structural/Watertight Integrity

♦☐Hatches & WT doors................................179.330 / 03107
*Class 2 & 3: local/remote controls, alarms, time*
☐Watertight bulkhead penetrations........179.320 / 03199
*Locations-high & inboard; watertight; no sluice valves*
☐Hull structure...........................................177.300 / 02199
*Damage, wastage & fractures*
*No unauthorized repairs*

### Pollution Prevention

☐Sewage system......................................33-159.57 / 14402
*Operation; Capacity; MSD approval*
*Instructions & warning placard posted*
*Overboard discharge valve is closed & secure*
☐Garbage handling....................................184.702 / 01320
*Plan compliance*
*Handling of plastics*
*Placards posted (>26')*
☐Oil pollution prevention.....................33-155.450 / 14502
*Placard posted (>26')*
- *Bilges free of debris & excessive oil..............176.830 / 07126*

☐Vessel General Permit (VGP)....CG-543 PL 11-01 / 99103
*Discharges & Log entries*

### Topside Equipment

♦☐Freeing ports & scuppers........................176.700 / 03112
*No modifications; unobstructed*
☐Ground tackle, mooring lines.................184.300 / 09228
*Suitability; Operation; Condition*
♦☐Port lights & vent openings.....................182.460 / 03106
*Covers - readily available & operational*
*Closing devices - proper fit & seal*
☐Fuel tank venting.....................................182.450 / 02107
*Condition and location*
*Flame screen(s)*
*Vent size*
☐Rails & guards..........................................177.900 / 03103
*Heights & courses (39.5", 200lb point load, 50lb uniform load minimum)*
*Storm rails; Guards for vehicles*

# SMALL PASSENGER VESSEL T-BOAT CHECKLIST

•☐ Human Factors & Safety Culture/Drills

*These questions are a sample of potential questions that a marine inspection can use to determine the efficacy of a safety culture aboard a vessel. Crews that are unable to provide satisfactory answers may be considered for a flag state detention.*

-Does the vessel create voyage plans?
*Who creates/monitors/verifies them and what are the criteria?*
-How often is lifesaving equipment checked by the crew (rafts, lifejackets, provisions, instructions, etc.)?
-What is the process of reporting/discarding/replacing faulty lifesaving system parts?
-How do you track preventative maintenance?
-What are your procedures if you receive an alarm?
-How often is the bilge system tested?
-What is the process for ordering CG approved equipment such as lifejackets or flares?
-What is the process for making vessel alterations?
-Does the vessel anchor? Describe the process.
- What procedures and watches are followed for overnight voyages?
-Do you know the limits of your stability letter/route?
-What is your response to any injuries onboard?
-What is your response to marine casualties?
-What is your response to loss of steering/propulsion?
-Do you have procedures for charging non-permanent lithium-ion batteries?
- What are the crew members' responsibilities for responding to an emergency?
- What are the crew members' responsibilities for the safe operation of the vessel?

☐ Emergency Drills General
-How do you check the weather prior to getting underway?
-What are your procedures if you suspect inclement weather while you are underway?
-How does the crew conduct crowd control during an emergency?
-How are crew members selected/ how is the crew rotation determined?
-What training is required for crew members and how often are emergency drills conducted for crew members on each vessel?
-How do you perform/evaluate/track your drills?
-What are the responsibilities for each crew member during emergency situations?
-How often are your emergency systems (emergency lighting, emergency alarms, public address system, etc.) operated and inspected for proper function?
-Did the drill follow the emergency instructions and/or placards posted?

☐Fire Drill………………………………………………185.524 / 04109
-Did crew member sound alarm?
-Did crew member attempt initial action?
-Verify effective comms with master/crew/pax.
-Did the Master turn the vessel into the wind, slow down, etc, and make announcements to crew/pax and make the call to local CG or good sam vessels?
-Verify crew's familiarity with use of equipment
-Did crew effectively fight fire with fire extinguishers, close off ventilation closures, secure power and fuel?
-Did the crew understand the agent(s) used?
-Did the crew know how to operate and deploy the Fixed Fire Extinguishing System and/or fire pump?
-How often do you charge a fire hose during drills?

☐Man Overboard Drill…………………………176.808 / CG004
-Witness launching and use of rescue boat
-Verify readiness and condition of rescue platform
-Verify effective comms with master/crew/pax.
-Did the crew throw 'Oscar' overboard?
-Did the crew call out "man overboard," vessel side and point to the victim?
-Did crew throw aid or other flotsam overboard?
-Was the waterlight attached to the ring life buoy and was it deployed immediately?
-Did the Master return on reciprocal?
-Did Master sound danger signal, mark position, course and speed, announce situation to crew/pax and simulate comms to CG/good Samaritan vessels?
-Did the Master approach the victim with a plan and was he successful?
-Did the crewmembers properly don PFDs, take control of the situation and direct passengers as appropriate?
-When alongside, did crewmembers have a plan for retrieving the victim?
-Verify ability to recover a helpless person
-When the victim was recovered, did the crew complete basic first aid that included the ABCs?

☐Abandon Ship Drill……………………………..176.808 / 04110
-Verify all lifejackets are correctly donned
-Witness means of launching survival craft
-Did the Master simulate broadcasting a mayday on the VHF radio and provide the vessel position, number of persons onboard and type of distress?
-Did the crew have a plan on how to deploy and marshal the vessel's primary lifesaving devices?
-Did the Master simulate activating the EPIRB?

# SMALL PASSENGER VESSEL T-BOAT CHECKLIST

## International

- ☐ PSSC ..................................................... SOLAS I/12 / 01103
- ☐ EIAPP (Diesel >130kW).............MARPOL VI/13.1 / 01125
- ☐ IAPP & Supplement (>400 ITC)......MARPOL VI/8 / 01124
- ☐ IAFS w/Record .................................AFS Article 3 / 01131
- ☐ IEEC (>400 ITC).......MEPC.203(62),CVC PL 13-02 / 01138
- ☐ IOPP (>400 ITC)..................................MARPOL I/9 / 01117
- ☐ SOVC MARPOL IV (>400 ITC)................33-159.53 / 01119
- ☐ Credentials...........................................STCW I/2.6 / 01299
  - *STCW endorsements*
  - *Vessel Security Officer endorsement*
  - *TWIC*
  - GMDSS endorsements
- ☐ ILLC (>150 ITC or ≥79')............................175.122 / 01108
- ☐ ISM-DOC............................................SOLAS IX/4.2 / 01106
- ☐ ISM-SMC...........................................SOLAS IX/4.3 / 01107
- ☐ ISSC & CSR...........................SOLAS 14 XI-1/5.5.2 / 01122
- ☐ Tonnage Certificate.....................................69.69 / 01132
- ☐ Garbage Placards, Plans, & Records
  - *Placard (>12m length)......................MARPOL 10.1.1 / 14502*
  - *Management Plan (≥15 POB).............MARPOL 10.2 / 14503*
  - *Record Book (≥15 POB)........................MARPOL 10.3 / 01320*
- ☐ Official logbook.........................................185.280 / 01305
- ☐ Maintenance Records.......................SOLAS IV/15 / 11199
  - *Survival craft.........................................SOLAS III/20.7 / 05116*
  - *Test reports for VHF-DSC, AIS, LRIT & SSAS.......SOLAS IV/17*
- ☐ SOPEP (>400 ITC).......................................184.702 / 01314
- ☐ Transfer Procedures (≥250 bbls).............184.702 / 14105
- ☐ Vessel's training log...........................SOLAS III/35 / 01305
- ☐ Oil Record Book (>400 ITC)............33-151.25(b) / 01315
- ☐ Voyage data recorder........................SOLAS V/20 / 10114
- ☐ AIS..................................................SOLAS V/19.2.4 / 10113
- ☐ Bridge navigation equipment.....SOLAS V/19.2 / 10105-7
  - *Spare magnetic compass*
  - *Pelorus or compass bearing device*
  - *Electronic plotting aide*
  - *Speed & distance measuring device*
- ☐ Immersion suits...........................................199.70 / 11119
- ☐ Outfits/equipment.................SOLAS II-2/10.10.2 / 07111
- ☐ Fire Control Plan..........................SOLAS II-2/15.3 / 07122
- ☐ Int'l Shore Connection..........SOLAS II-2/10.2.1.7 / 07118
- ☐ Communication equipment (Sea Area)
  - *NAVTEX.......................................................47-80.1101 / 05110*
  - *Portable VHF(s)..........................................47-80.1095 / 05109*
  - *AIS-SART................................................SOLAS III/6.2.1 / 11123*
  - *GMDSS radio equipment..........................47-80.1095 / 05118*
- ☐ LRIT.......................................................33-169.205 / 10137
  - *Conformance test report*
- ☐ Depth sounder..........................SOLAS V/19.2.3.1 / 10117

## International – Security

- ☐ VSP/ASP................................................33-104.120 / 16103
  - *Secured*
  - *Amendment(s)*
- ☐ Security records.................................33-104.235 / 16107
  - *Records of Training/Drills*
  - *Declarations of Security (DoS)*
  - *Annual exercise/Audit*
- ☐ Security equipment............................33-104.292 / 16107
  - *Equipment matches plan*
  - *Maintenance records*
- ☐ Crew's security knowledge................33-104.200 / 16106
  - *CSO/VSO*
  - *VSO knowledge of responsibilities*
  - *Crew's knowledge of their responsibilities*
  - *Compliance with MARSEC*

## SV Addendum – NVIC 2-16

- •☐ MMC – Aux. sail endorsement.............15.901(d) / 01201
- ☐ Rigging Plan..............................................177.202 / 99101
  - *Vessel information & structure particulars*
- ☐ Sail Area Plan (Sail Plan)..........................177.202 / 99101
- •☐ Spar(s) & fittings.......................................176.802 / 99101
- •☐ Standing rigging components.................176.802 / 99101
- ☐ Rail configuration.................................177.900(f) / 03103
- •☐ Running rigging components..................176.802 / 99101
- ☐ Rigging/hull components under sail.......176.802 / 99101
  - *Condition of sails*
  - *Crew's ability to set/strike sails/safety aloft*
  - *Passenger safety*
- •☐ Catamaran forestay.................................176.802 / 99101
- ☐ Man overboard drill under sail..............185.420 / CG004
- ☐ Hull/mast internal support structure.....176.802 / 02199
  - *Mast partner/step structure*
  - *Chain plate backing / reinforcement to hull*

## Wood Addendum

- •☐ Survival craft...............................180.200 / 11101/4/8/27
- •☐ Bilge & high-water alarms.......................182.530 / 13104
- ☐ Subdivision & damage stability..............179.210 / 02199
  - *Collision bulkhead (>65' | >49 pax | exposed waters | wood hull after 2001 & cold water | >40' & partially protected)*
  - *Subdivision (>65' | >49 pax | wood hull after 2001 & >12 pax | SOLAS)*
- ☐ Wood hull.................................................176.610 / 02199
- ☐ Wood hull fasteners.............................NVIC 7-95 / 02199
- ☐ Internal inspection of wood hull............176.610 / 02199
- ☐ Repair(s)...................................................176.610 / 02199

*Submit any change requests to CG-CVC@uscg.mil.*



Clear Form

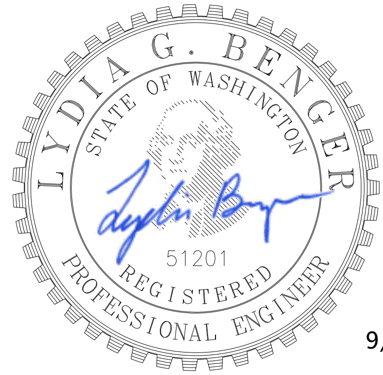
# Attachment 2

## Emissions Evaluation

ELLIOTT BAY
DESIGN GROUP

# MEMORANDUM

| | |
|---|---|
| From: | Lydia Benger, P.E. |
| Reference: | 23112-02M, Rev B |
| Date: | 9/11/2024 |
| Subject: | COLSAC III Emissions Evaluation |




9/11/2024

Wisconsin Department of Transportation (WisDOT) has contracted with KPFF and Elliott Bay Design Group (EBDG) to carry out the Performance and Reliability Study of the Merrimac Ferry COLSAC III. As part of this study, EBDG has been tasked to evaluate the emissions production of the ferry COLSAC III. The results of this evaluation are presented herein. Comparison of existing emissions with any future vessel alternatives will be provided in subsequent documents, this memo serves as a baseline.

## GIVEN AND ASSUMED PARAMETERS

The estimated annual Carbon Dioxide ($CO_2$), Nitrous Oxide (NOx), Carbon Monoxide (CO), Hydrocarbon (HC), and Particulate Matter (PM) emissions are calculated based on the annual fuel consumption, operating engine loads and operating hours for the engines.

The COLSAC III operates 24 hours per day between April and November or nominally 244 days per year. Traditionally, the vessel operates when the river is free of ice, but 244 operating days, as modified below, will be used as a standard for future comparisons.

There is no set operational schedule, thus the ferry provides on-demand service to its customers. As such, EBDG assumes that the vessel, and the operating engine, is at idle for 50%, or 12 hours, per day. Likewise, the operating engine provides propulsion for 12 hours per day. Assuming 244 days of operation with 85% availability, an engine is idling for 2,489 hours and providing propulsion for 2,489 hours. The 85% availability accounts for refueling, cable changing and other maintenance activities that take the ferry out of operation.

The vessel has two Tier 3 Cummins 6.7-liter QSB6.7 engines rated for 282 brake horsepower (210 bkW) at 1,800 RPM, Reference [1]. The vessel typically rotates between the two installed main engines, such that only one engine is in operation at a given time.

EBDG estimates that the vessel requires 80% of the rated engine power for propulsion. This equates to 226 hp, or 168 kw. This estimate may be conservative and will be refined during the subsequent comparison studies.

EBDG estimates that the engine produces 20 hp or 15 kW when idling.

It is standard practice to measure emissions in metric units.

$CO_2$ generation is a function of the diesel fuel burned where 1,080 grams of $CO_2$ is generated for every gallon of diesel burned. The annual fuel consumption is based on the 2023 fuel purchase data provided by WisDOT, Reference [2].

The Federal Marine Compression-Ignition (CI) Engines: Exhaust Emissions Standards, Reference [3] is used to estimate the HC, NOx, PM, and CO emissions production. This reference defines the maximum allowable emissions for an EPA approved engine and may be conservative if compared with manufacturer provided emissions factors. For an engine of this size and tier, the standards for maximum HC and NOx are combined and will thus be calculated as a single emission value.

## ANNUAL $CO_2$ PRODUCTION

In 2023, the ferry operation purchased 21,165 gallons of diesel fuel. Assuming this same amount of diesel was burned in that year, the ferry produced 215 metric tons of $CO_2$.

## ANNUAL HC+NOx PRODUCTION

Based upon the Marine Exhaust Emissions Standards, Reference [3], the vessel produces 5.4 g/kwh or 2,458 kilograms of HC+NOx annually.

## ANNUAL PM PRODUCTION

Based upon the Marine Exhaust Emissions Standards, Reference [3] the vessel produces 0.12 g/kwh or 55 kilograms of PM annually.

## ANNUAL CARBON MONOXIDE (CO) PRODUCTION

Based upon the Marine Exhaust Emissions Standards, Reference [3], the vessel produces 6.6 g/kwh at idle and 5.0 g/kwh in propulsion or 2,337 kilograms of CO annually.

## SUMMARY

Table 1 provides a summary of all emissions produced by the COLSAC III on an annual basis.

*Table 1: Annual Emissions Summary*

| EMISSION | VALUE |
|---|---|
| CO2 | 215 mt/year |
| HC+NOx | 2,458 kg/year |
| PM | 55 kg/year |
| CO | 2,337 kg/year |

## REFERENCES

[1] Price Engineering, "Columbia Country Hwy Dept Colsac III Hydraulic Schematic, PEA-B8467H, Rev A," 12/29/23.

[2] Columbia County Highway & Transportation , "Ferry Fuel Usage 2023".

[3] Environmental Protection Agency, "Federal Marine Compression-Ignition (CI) Engines: Exhaust Emission Standards," EPA-420-B-20-021, July 2020.

# Attachment 3

kpff

## Landing Site Assessment Report

1601 Fifth Avenue, Suite 1600 Seattle, WA 98101 206.622.5822 kpff.com

# FIELD REPORT

| | | | |
|---|---|---|---|
| To: | WisDOT | Date: | June 19, 2024 |
| | | Job No.: | 240000231 |
| By: | Chris Ligozio, Senior Engineer<br>KPFF Consulting Engineers | Project: | Merrimac Ferry Study |
| | | Location: | Lodi/Merrimac |

A site visit was conducted on June 19, 2024, to assess the two Merrimac Ferry landings. The following was noted:

## NORTH LANDING

Steel sheet pile bulkheads were inspected from the water. Conditions were similar at both the north and south landing and are shown in photos below.

- Sheets are uncoated and in generally good condition with no visual evidence of section loss.
- Concrete cap is in good condition with limited, tight cracks and no significant spalling.
- Asphalt paving behind the concrete caps is worn, cracked and uneven.
- Steel handrails are intact with no signs of corrosion or damage. Railing coatings show signs of weathering. Isolated missing base plate anchor bolts and nuts were observed with no likely loss of service.
- Bollards were in good condition with no signs of corrosion.

Riprap slopes were also inspected from the water. Typical Conditions shown in photo below.

- Slopes appear stable, without significant areas of missing or deteriorated stones.

### Vessel Ramps

- Concrete at and below waterline. South in good condition. Full depth cracking and concrete deterioration observed in north ramp at traffic lane 1 (east half of ramp).
- Asphalt immediately above concrete at both landings is rutted at vessel ramp landing locations. County indicated that vessel ramps were lowered into fresh asphalt to form ruts.
- Asphalt at center of all three travel lanes at north landing was abraded.

### Upland Paving General Condition

- South Landing in very good condition. Fresh Asphalt
- North Landing in fair to good condition. Older asphalt with some wear and cracking.

### Drive Cable

- Cable and hardware in fair condition. Inspection of cable over top of upper drive sheave on vessel. Some flattening of outer wires. No broken wires observed. No cable corrosion observed. Significant marine growth pressed into cable near south landing; cable picks up sediment in main channel. County to provide drive cable specifications.

- Vault and anchorage – Concrete is sound. Tops are not watertight. Some water was observed in the South pit, but it is possibly due to pit being opened during rain shower. Standing water, 7-inch deep, observed in North Anchor pit, with cable conduit pipe serving as drain. County claims that they occasionally pump water from the north pit. Pit could be gravity drained back to river. There is a slight gap beneath the south end of the directional sheave base plate. This should be monitored to make sure anchor bolts are stable. The gap should be sealed to prevent possible corrosion of the base plate.
- Trough – There is some concrete deterioration / spalling with some exposed reinforcement along the top of north trough wall. Trough covers are steel with minor surface rust. Plastic vertical cable guides at exit points are worn, especially on the east side of the cables.
- Vault covers – trough covers are uncoated steel with surface rust. Tie down bolts were intact and tight. Anchor pit covers are aluminum and in good condition.

## Guide Cables

- Cable and hardware are in good condition. Guide cables have a plastic sheathing that was worn through at the South landing. County indicated that the wear was a result of the winter layover at the south landing. Minor corrosion of cable ends (both landings) and cable wedges (south landing) was observed.
- Vault & anchorage. Vaults are in good condition. Anchorage plate and short anchorage cables at south landing vault show signs of corrosion that should be addressed. West anchorage was not inspected, but conditions are likely similar.
- Troughs were in good condition, with a minor spall at the north east cable trough due to impact of the mooring clip connected to the cable.
- Vault covers were all aluminum and in good condition.

## Recommendations

***Items that should be addressed this summer, if possible***

- Corrosion of short anchor cables, south landing guide cables. The plastic coating should be removed and cables coated with grease and/or penetrating sealer to prevent continued corrosion. Anchor plates should be blast cleaned and painted and short cables replaced with the next guide cable change.
- Standing water in North drive cable pit should be pumped out regularly, likely after any significant rain.
- Mooring clip at north end of east guide cable should be removed or rotated, to prevent further damage to concrete trough.
- Missing anchor bolts and nuts on pedestrian railing base plates should be sealed to prevent water intrusion and potential corrosion of the lower surface of the base plates.

***Items that should be addressed in the next maintenance period:***

- Damage to top of north drive cable trough should be repaired.
- Drain should be added to the north drive cable anchor pit.
- Vessel Ramp landing points could be redesigned to provide better support to the ends of the ramps and low friction interfaces. This might also be considered during vessel renovation.

***Items that should be monitored***

- Ongoing wear of drive cable guides at exit troughs. Recommend having replacement guides on hand for future replacement.
- Gap beneath the base plate of the deviation sheave base plate in the south drive cable anchor pit. If gap grows, anchor bolts may need to be tightened, or sheave support re-designed.
- Damaged concrete ramp at North landing. If settlement of the concrete or asphalt above the concrete ramp is noted, damage to ramp should be repaired.

***Issues / Improvements that can be made in conjunction with a new or renovated vessel.***

- Implementation of drive cable NDT. This could be installed along with cable wash system in current vessel configuration. There exist several commercially available systems that utilize magnetic flux leakage (MFL) to detect section loss and individual wire breaks in wire ropes. Having actual quantified rope condition data would improve the cable inspection process and allow the county to extend the service life and better utilize the cable.
- Reconfiguration of drive cable anchorages and implementation of a continual replacement approach. Given that wear is not uniformly distributed along the length of the cable, it might be possible to replace the drive cable in segments from one side to the other. If it is possible to re-design one of the anchorages to allow continual feeding of rope from a large spool, the drive cable could be replaced a few hundred feet at a time, moving worn areas along the length of the cable, providing for even wear. This will also impact the replacement sequence.
- Improvements to drive cable specifications. It might also be possible to specify a wire rope with improved wear characteristics. The county / DOT is reporting a seemingly wide variation in cable life between different suppliers. The county is going to provide more information regarding the cable specifications and the actual cable coil tags. We should do some more research to try and understand why they have variation and see if there may be a better option and/or other suppliers

# FIELD REPORT


***Figure 1: Steel Sheet Piling, Typical Conditions, SE Corner Shown***

***Figure 2: Asphalt Paving behind sheet pile bulkhead, Typical Conditions, SW corner shown***

# FIELD REPORT

***Figure 3: Typical Missing pedestrian railing Anchor bolt nut, SE landing shown.***

***Figure 4: Riprap slope, Typical Conditions, NE Corner shown***

*Figure 5: Vessel Ramp, South Landing*

*Figure 6: Vessel Ramp, North Landing*

*Figure 7: Cracked and deteriorated Concrete, North Landing, Lane 1*

*Figure 8: Asphalt abrasion at loading lane centerline, North Ramp*


*Figure 9: Upland Pavement, North Landing*

*Figure 10: Upland Paving, South Landing*

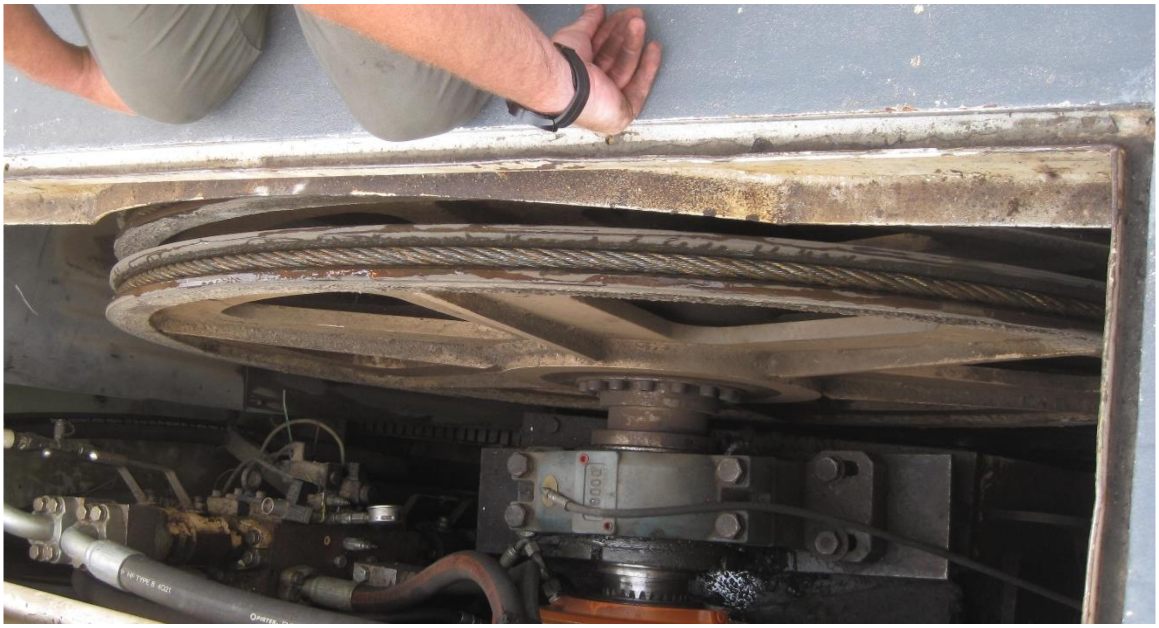


***Figure 11: Drive Cable inspection at upper Drive Sheave on vessel***

***Figure 12: Drive Cable, Marine growth near South landing***

# FIELD REPORT

***Figure 13: Drive Cable Anchorage, South Landing***

***Figure 14: Directional sheave, slight gap beneath south end of baseplate***

# FIELD REPORT

***Figure 15: North drive cable anchor pit; standing water***

***Figure 16: Drive Cable trough concrete spalling, North Landing***

***Figure 18: Uneven Wear of drive cable guides at trough exit locations, south (left)***

***Figure 19: East Guide Cable at south Landing, worn coating***

***Figure 20: Corrosion of short anchor cables and main cable wedges, southeast guide cable anchor pit.***

***Figure 21: Corrosion of Anchor plate and short anchor cables at south anchor of east guide cable***

*Figure 22: Minor concrete spalling due to mooring clamp at northeast guide cable trough*

# FUTURE OPERATIONS AND OPPORTUNITIES MEMO

## Appendix C

# MEMO

| | |
|---|---|
| *Date:* | September 27, 2024 |
| *To:* | Wisconsin Department of Transportation |
| *From:* | KPFF Consulting Engineers |
| *Subject:* | Review of Future Operations Opportunities |

# 1 INTRODUCTION

Wisconsin Department of Transportation (WisDOT) is conducting the Merrimac Ferry Performance and Reliability Improvement Study to develop alternative concepts that improve service reliability, reduce vessel emissions, and meet the needs for all modes of travel for both the short- and long-term future of this ferry service.

This memo is intended to support development of recommendations for the future operations of Merrimac Ferry service. To provide context for understanding the opportunities and challenges of the current county-based operations and maintenance service model, the following information was reviewed:

- Overview of ferry service provider models and key opportunities and challenges for agencies
- Summary of current Merrimac Ferry operations and assessment of historical operating costs
- Comparison to similar North American cable ferry operations, service levels, and operating costs

Key findings from this review include the following:

- Merrimac Ferry maintenance is performed by small, dedicated, and well-trained staff. It appears unlikely that changes to the service delivery model, such as contracting vessel operations and maintenance to a private operator or utilizing DOT staff for direct agency delivery of service, would result in efficiencies or cost savings.
- While direct comparison of cable ferry operating costs is challenging due to differences in service levels, vessel sizes, and crossing lengths, Merrimac Ferry operations appear to be in line with peer operators.

# 2 OVERVIEW OF GOVERNANCE MODELS

Governance structure, the organizational means through which ferry service is delivered, is a key factor in shaping and funding service. Different governance models include varying levels of agency involvement. There are three basic models for service delivery which include:

- **Privately owned and operated service:** Delivery is provided by a private operator, without agency involvement. Unlike publicly owned or operated systems, privately owned and operated ferry providers are ineligible for federal grants for capital improvements or local funding subsidies. To sustain their company operators must recover all capital and operating costs through fares and non-fare revenue such as concessions.
    - *Opportunities*: No commitment required by state resources.
    - *Challenges*: Ferry service must recover sufficient revenue through fares to be profitable, and agencies have limited or no control over fare levels and service schedules.
- **Public/private partnership:** The governing agency contracts for provision of transportation service, with varying options for ownership and maintenance of assets. For example, the agency may own terminals and vessels and contract with a private company for vessel operations and maintenance. The contract relationship typically involves agency control over aspects of the service such as fare levels and service schedules, and stipulates requirements on the operator such as data and revenue reporting, and performance measurements and targets.
    - *Opportunities:* Can contract operations to an established operator instead of hiring dedicated ferry operations and/or maintenance staff, while providing opportunity for oversight and control over service planning.
    - *Challenges:* Requires dedicated agency resources for contract administration. Contract must be thoughtfully structured to ensure that service and vessel maintenance performance metrics are included and met.
- **Direct agency delivery:** In this option, the agency manages and operates service, providing the most control over service levels and standards but also requiring the greatest commitment of infrastructure and resources by the agency. Typically, agency delivery requires a dedicated source of revenue/subsidy.
    - *Opportunities:* Provides the highest level of control over fare levels, service schedule, and quality of service.
    - *Challenges:* Requires the highest level of agency resources. Likely requires dedicated ferry staff and/or a dedicated department, which may be inefficient for agencies with limited ferry service.

## 2.1 Overview of Merrimac Ferry Service

### Governance

The Merrimac Ferry and landing facilities are state-owned components of the state highway system. Service is delivered through a partnership between WisDOT and Columbia County. Responsibilities are outlined below.

- WisDOT, Bureau of Structures / Southwest Region
    - Ownership of vessel and landing sites
    - Funding ferry operations and capital improvements
    - Planning and implementing future improvements
    - Provide traveler information and service updates
    - Manage contract with Columbia County for ferry operations and maintenance
- Columbia County, Highway and Transportation Department
    - Provide dedicated staff, including staff four operators and one mechanic, to operate and maintain the ferry under contract with the state
    - Manage ferry repairs, maintenance planning, and parts ordering and inventory

### Merrimac Ferry Operating Costs

Yearly operations and maintenance costs are collected by Columbia County and categorized as follows:

- Labor: The wage and fringe costs for employing vessel operators and mechanics
- Material: The physical materials that are required for the upkeep and maintenance and continued operations of the ferry. These costs include fuel, technical representatives for engine/auxiliary systems service, spare parts, and other miscellaneous costs that are directly tied to vessel operations.
- Machine: The cost of maintaining the shoreside equipment (crane and trucks to support vessel cable change-out, and other miscellaneous needs).
- Admin: The cost of administrative staff and program management within the county to support ferry service operations.

Historic annual operating costs from 2003-2023 are presented in Figure 1, showing a steady annual increase in costs, with some years of notably higher materials costs.

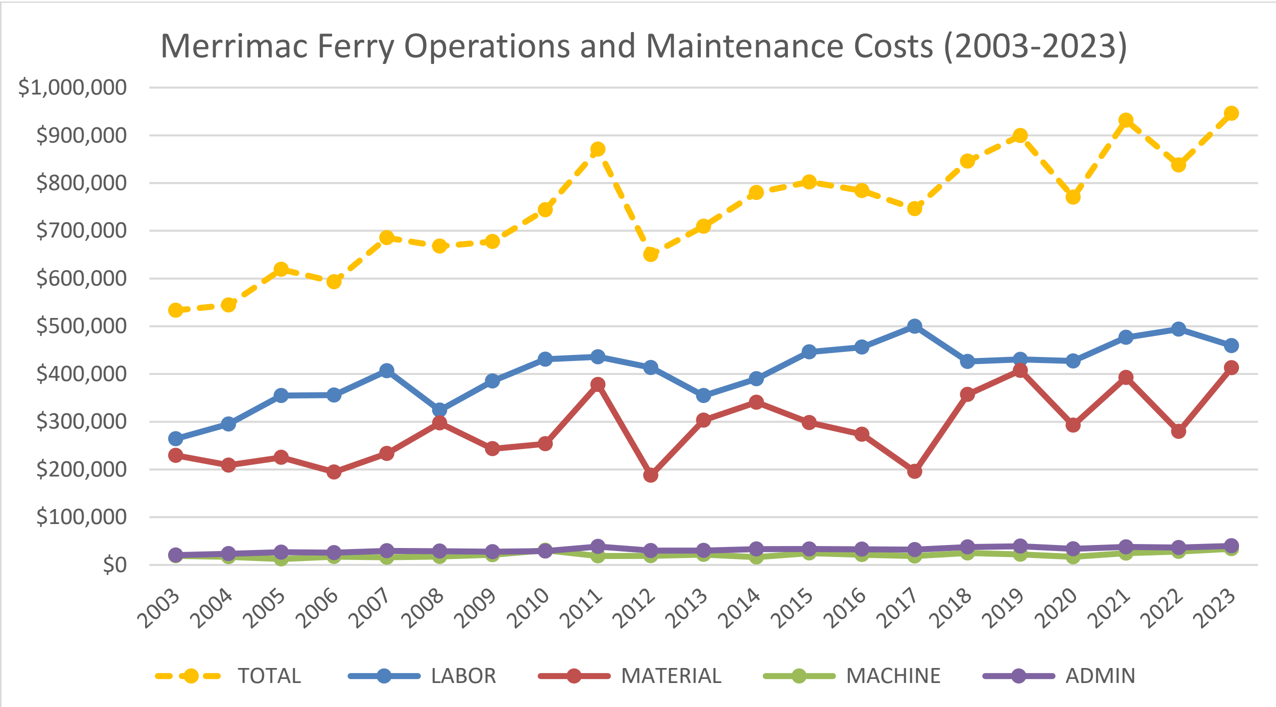



***Figure 1: Historical Operating Costs (2003-2023)***[1]

A breakout of average operating costs by category between 2019-2023 is presented in Figure 2.

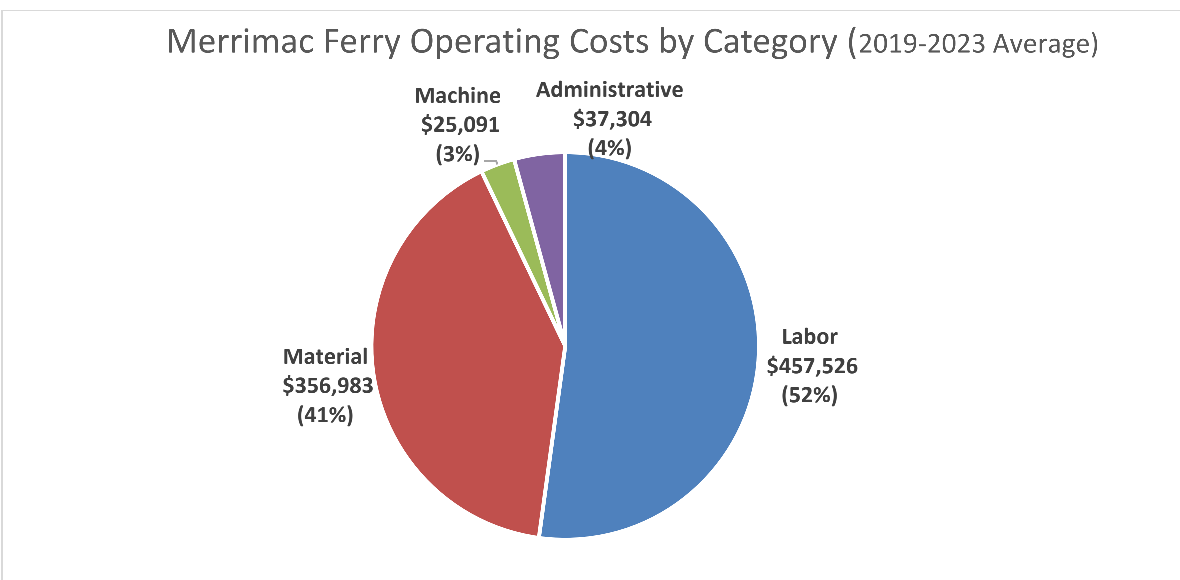



***Figure 2: Merrimac Ferry 2019-2023 Average Annual Operating Costs***

[1] Historical operating costs not adjusted for inflation.

# 3 REVIEW OF PEER FERRY OPERATIONS

To provide context for review of current Merrimac Ferry operations, service characteristics and operating costs were benchmarked against those of similar ferry services. Operators selected for comparison provide both vehicle and passenger service on short, rural cable ferry crossings; however, direct equivalency is challenging due to the differences in vessel size and crossing length, funding, ridership, and service levels.

The following cable ferry operations were reviewed, with comparison presented in Attachment 1:

**Buena Vista and Wheatland Ferries, OR:** Two cable ferries crossing the Willamette River, operated year round by Marion County Public Works. The Wheatland Ferry is Oregon's oldest ferry crossing, created in 1844, followed by the Buena Vista ferry created in 1852.

*Figure 3: Canby Ferry – M.J LEE II*[2]

**Canby Ferry, OR:** Operated by Clackamas County, the Canby Ferry has crossed the Willamette River since 1914.

**Ironton Ferry, MI:** The county-operated Ironton Ferry operates seasonally across a narrow arm of Lake Charlevoix. The ferry began operation in 1876.

**J-Mack Ferry, CA:** The J-Mack Ferry, operated by the California State Department of Transportation (Caltrans), crosses Steamboat Slough in the Sacramento Delta year round, 24 hours a day.

**Baynes Sound Connector, B.C. Canada:** The longest cable ferry crossing in the world, at over 1.2 miles, connecting Vancouver Island and Denman Island. The vessel is the first and only cable ferry in the BC Ferries fleet, and uses two guide cables and one drive cable.

*Figure 4: BC Ferries Baynes Connector*[3]

[2] https://www.clackamas.us/roads/ferry#technicalspecsandhistory

[3] https://www.bcferries.com/on-the-ferry/our-fleet/baynes-sound-connector/BSC_

Figures 5 through 7 show the breakout of average operating costs over recent years for three of the cable ferry operations selected for comparison.

While each operator categorizes costs slightly differently, in general, each of the three operators has a higher percentage of costs associated with labor, whereas Merrimac Ferry's labor accounts just over 52% of overall costs with a higher percentage of costs associated with materials (as shown in Figure 2).

A comparison of operating and service characteristics, along with total operating costs are presented in Attachment 1.

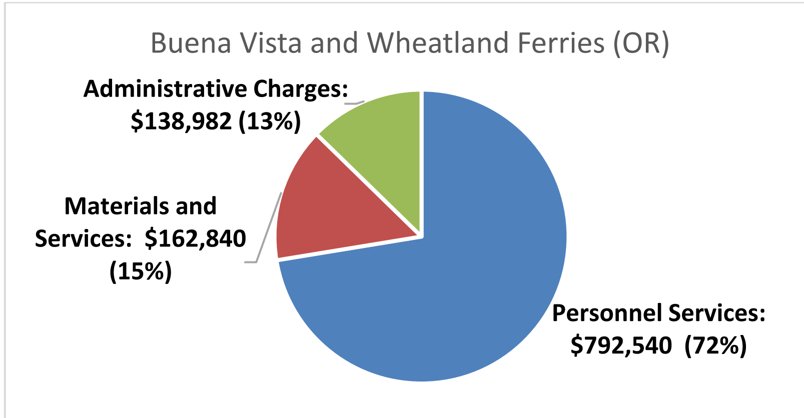



***Figure 5: Buena Vista and Wheatland Ferries 2020-2022 Average Annual Operating Costs[4]***

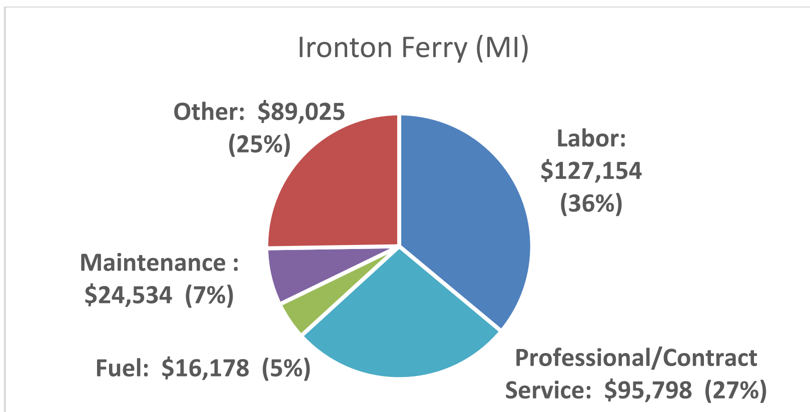



***Figure 6: Ironton Ferry 2020-2024 Avg. Annual Operating Costs***

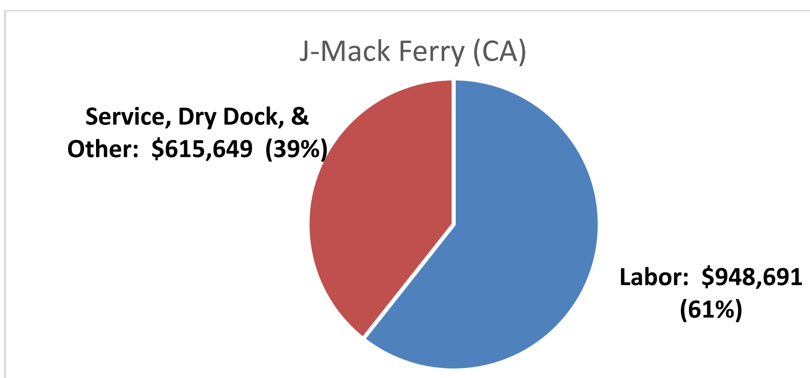



***Figure 7: J-Mack Ferry 2018-2022 Avg. Annual Operating Costs[5]***

[4] Marion County Annual Budget Fiscal Year 2023-2024. https://www.co.marion.or.us/FIN/budget/Documents/FY%2023-24%20Budget/000%20Annual%20Budget%20FY%202023-24.pdf

[5] https://ig.dot.ca.gov/-/media/ig-media/documents/program/p4000-0415-delta-ferries-final-report.pdf

# Attachment 1

*Table 1: Comparison of Cable Ferry Operations and Service Characteristics*

| | Merrimac Ferry, WI | Buena Vista Ferry, OR | Wheatland Ferry, OR | Canby Ferry, OR | Ironton Ferry, MI | J-Mack Ferry, CA | Denman Island – Buckley Bay, B.C. |
|---|---|---|---|---|---|---|---|
| ***Operations Characteristics*** | | | | | | | |
| **Vessel Description** | 105-foot, 15-car diesel hydraulic powered cable ferry | 63-foot, 6-car cable-guided ferry with capacity for 49 passengers | 90-foot, 9-car cable-guided diesel-electric ferry with capacity for 49 passengers | 55-foot, 6-car electric powered cable ferry with capacity for 43 passengers | 50-foot, 4-car diesel-hydraulic cable ferry with capacity for 38 passengers | 92-foot, 6-car diesel-powered cable ferry | 258-foot, 45-car diesel-powered cable ferry with capacity for 146 passengers |
| **Year of Construction** | 2003 | 2011 | 2001 | 1997 | 1926 | 1969 | 2015 |
| **Crossing Length** | 2,640 feet | 720 feet | 580 feet | 670 feet | 610 feet | 400 feet | 6,435 feet |
| **Operating Organization** | Vessel and terminals owned by WisDOT; operations and maintenance contracted to Columbia County | Owned, operated and maintained by Marion County Public Works | Owned, operated and maintained by Marion County Public Works | Clackamas County | Owned and operated by Charlevoix County, with funding received from the state | Caltrans | BC Ferries |
| **Staff/Crew Levels** | 1 operator | 1 operator | 1 operator | 1 operator | 1 operator | 1 operator | 1 operator, 3 crew |
| **Coast Guard Regulated** | No[6] | Yes | Yes | Yes | Yes | Yes | Yes (Transport Canada) |
| ***Service Levels and Operating Hours*** | | | | | | | |
| **Seasonality** | April-December | Year-round | Year-round | Year-round (as conditions allow, ~225 days/year) | Seasonal (Apr-Nov) | Year-round | Year-round |
| **Operating Hours** | 24-hours (on-demand) | 7:00am – 5:30pm (on-demand) | 5:30am – 9:45pm (on-demand) | 9:00 am - 6:00 pm (on-demand) | 6:30am – 10:30pm (on-demand) | 24-hours (on-demand) | 7:00am – 9:30pm |
| **Typical Daily Trips** | Avg. 158 daily trips | Est. 70 cars/day | Est. 700-900 passengers/day | 74 trips/day | 100 trips/day | 200 trips/day | 15-23 daily round trips<br>6,257 annual round trips |
| **Approximate Annual Traffic** | About 200,000 vehicles/year (5-year avg) | 30-40,000 riders per year | 250,000-300,000 riders/year | 50,000 vehicles per year | 162,000 passengers/year | 60,000 vehicles per year | 326,000 vehicles per year |
| ***Financial*** | | | | | | | |
| **Fares** | None | Pedestrian --- Free<br>Bicycle --- $1<br>Motorcycle --- $2<br>Vehicles:<br>-$3 (less than 22')<br>-$6 (over 22', less than 42')<br>-$9 (over 42')<br>-$18 (single vehicle using entire ferry) | | Motorcycles, bicycles, pedestrians --- $3<br><br>Vehicles:<br>-$5 (less than 22')<br>-$10 (over 22')<br>-$15 (entire lane)<br>-$30 (entire ferry) | Pedestrian --- Free<br>Bicycle --- $1<br>Vehicles:<br>Single Ride: $5.00<br>A book of 20 tickets: $50.00<br>Monthly unlimited: $75.00<br>Annual pass: $500.00 | None | *Round Trip Fares*<br>Passenger --- $9.85<br>Motorcycle --- $11.60<br>Standard Vehicle: $22.90 |
| **Annual Operating Costs** | $945,865 *(2023 total)* | $1,306,780 *(2022-2023 budgeted, excl. capital outlay)* | | $609,253<br>*(2025 forecast)* | $353,000<br>*(average 2020-2024)* | $1,564,340<br>*(average 2018-2022)* | $6,873,000 CAD<br>*(average 2022-2023)* |

[6] Due to the operating environment of the crossing, the Merrimac Ferry is exempt from U.S. Coast Guard requirements for both vessel construction and maintenance, as well as crew licensing.

# ALTERNATIVES ASSESSMENT MEMO

## Appendix D

ELLIOTT BAY
DESIGN GROUP

LYDIA G. BENGER
STATE OF WASHINGTON
51201
REGISTERED
PROFESSIONAL ENGINEER

11/23/2024

# COLSAC III

## VESSEL ALTERNATIVES ASSESSMENT

Prepared for: KPFF | Seattle, WA

Ref: 23112-061-2

Rev. -

November 23, 2024

## PREPARED BY

ELLIOTT BAY DESIGN GROUP
PO BOX 45790
SEATTLE, WA 98145

## REVISIONS

| REV | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| - | Initial Issue | 11/23/24 | LGB |

PAGE

# 1. PURPOSE

Wisconsin Department of Transportation (WisDOT) has contracted with KPFF and Elliott Bay Design Group (EBDG) to evaluate future design options for the Merrimac Ferry. The existing ferry, the COLSAC III, is a double ended, cable driven ferry that operates between Sauk and Columbia counties on the Wisconsin River. This report evaluates design considerations for the Merrimac Ferry with a primary focus on a future propulsion system.

# 2. PROCEDURE

## 2.1 STUDY OVERVIEW

A vessel's propulsion system is a primary component in determining the capital cost, operational cost, and environmental impact of a vessel. This study evaluates three propulsion options for the Merrimac Ferry: a new diesel system equivalent to the existing system, a battery electric diesel hybrid system and an all-electric system with shore power charging.

Additionally, this study builds on the vessel assessment, reference [1], conducted by EBDG in June 2024, and discusses potential structural and cable arrangement options.

## 2.2 EVALUATION CRITERIA

This study examines the propulsion options in terms of the following criteria:

- Feasibility - Evaluates if the equipment can be arranged on the vessel and if the vessel has capacity to accommodate the system weight.
- System Reliability - Qualitatively evaluates the reliability of the systems relative to each other.
- Ease of Maintenance - Analyzes the obstacles faced by each system's maintenance program and resulting parts or service sourcing.
- Service Levels - Qualitatively compares the service levels based on number of trips per day and required standby time.
- Crewing Needs - Analyzes the crew requirements influenced by propulsion system selection.
- Energy Consumption – Quantitatively analyzes energy consumption and resulting emissions.
- Capital Cost - Parametric capital construction cost estimate.
- Shoreside Improvements - Discussion of required shoreside infrastructure modifications.

# 3. GIVEN AND ASSUMED PARAMETERS

## 3.1 ROUTE DEFINITION

The Merrimac Ferry is a cable ferry that operates on the Wisconsin River between Columbia and Sauk Counties. The ferry with a capacity of up to 15 vehicles plus bicycles and pedestrians, with peak volume reaching 1,200 vehicles daily. Figure 1, below, depicts the route.

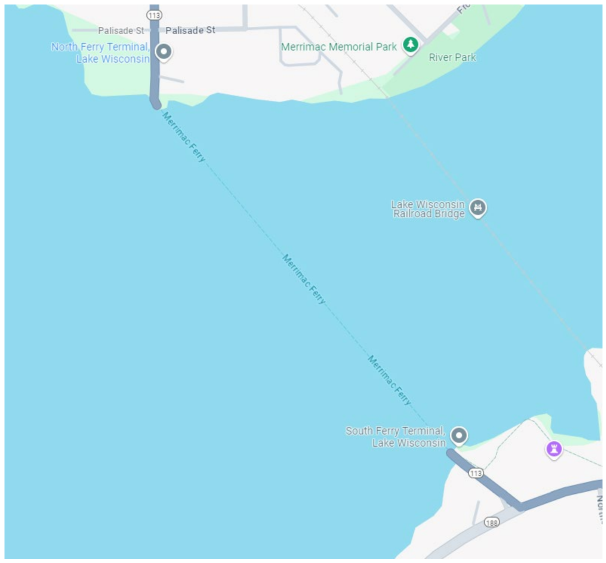



*Figure 1: Merrimac Ferry Route*

## 3.2 HOTEL LOAD ESTIMATION

A vessel's hotel load is the non-propulsion power demand. This is comprised of auxiliary systems such as heating, ventilation, air conditioning, lighting, machinery cooling, and electronics. The current vessel is assumed to have a hotel load of 15 kW, as it has a simple electrical installation.

Based upon EBDG experience, when propulsion systems include electric hybrid equipment and energy storage systems, the hotel load is greater than an equivalent nonelectric propulsion vessel. This is due, in part, to additional required cooling systems. Thus, for the hybrid and all-electric options, this analysis assumes a hotel load of 30 kW.

## 3.3 PROPULSION POWER PROFILE

The propulsion power profile assumes that the current engine operates at 80% load, or 168 kW, while crossing the river. This assumption is the same as was used in the Emissions Evaluation, reference [2], so all new options can be compared to the existing vessel. The 80% power assumption is an industry standard for propulsion engine selection and can be refined in future design processes.

## 3.4 OPERATING SCHEDULE

The Merrimac ferry operates 24 hours a day in an on-demand fashion. When either side requests a ride, the operator moves the vessel to transport the customer. The ferry does not have a set operating schedule.

During the vessel inspection, WisDOT stated that on a typical day, the ferry can be expected to run constantly for 2 hours between the terminals. This is reflective of a morning, evening, and/or lunch rush. For this study, EBDG evaluated each option over a 24-hour window assuming 12 hours of continuous operation and 12 hours of standby, consistent with reference [2]. The ability of each option to maintain continuous operation will differ based on equipment selection and battery charging requirements.

# 4. FUTURE DESIGN OPTIONS

## 4.1 CABLE ARRANGEMENT OPTIONS

As described in the Vessel Assessment, reference [1], the existing Merrimac Ferry is experiencing premature cable failure requiring replacement every eight weeks. A cable wash has been advised as a modification to the vessel and is recommended for all build options.

The existing cable arrangement consists of four sheaves as shown in Figure 2. This requires the cable bend around the outside of the sheaves five times each time the vessel passes over a section of cable.

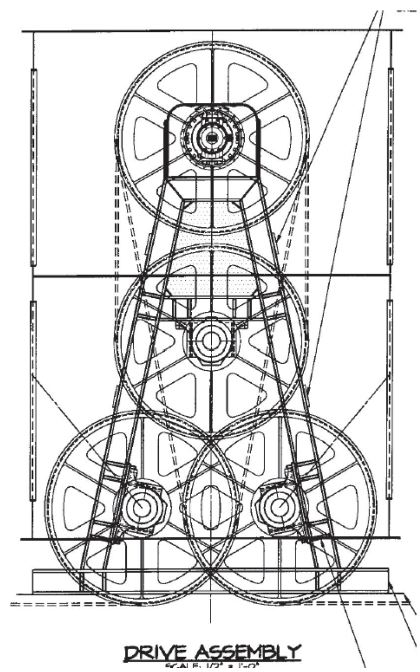



*Figure 2: COLSAC III Cable Arrangement*

Every time the cable bends and straightens the cable experiences a reversed bending stress cycle. Ferrous materials have cyclic stress limits, or fatigue limits, below which the material can experience infinite cycles without fatigue failure. Where the stress loading on the cable cannot be kept below the material fatigue limit, reducing the quantity of cycles the cable experiences will increase the life of the cable.

A two-sheave cable arrangement would result in only two cable bends each time the vessel passes over a section of cable. This would significantly reduce the quantity of cycles the cable experiences and thus increase the life of the cable. Additionally, the sheaves, while potentially requiring a larger area at deck level to accommodate larger diameter wheels, would overall take up markedly less volume in the machinery house. An example arrangement with two sheaves from an existing EBDG design is show in

Figure 3. Each wheel would be powered by an independent motor, providing redundancy in the propulsion system with both sheaves able to drive the vessel.

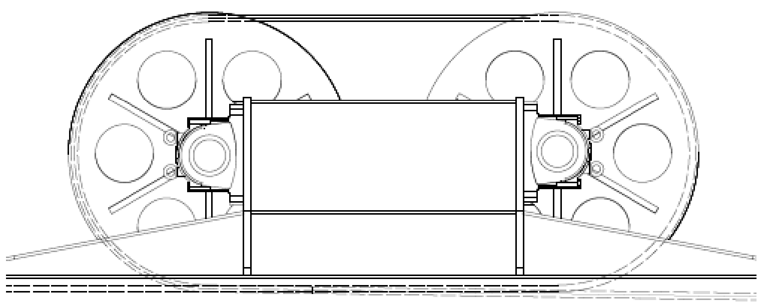



*Figure 3: Two Wheel Cable Arrangement*

## 4.2 STRUCTURAL DESIGN OPTIONS

### 4.2.1 RETAIN EXISTING HULL

As noted during the vessel assessment, reference [1], the existing hull structure is in excellent condition. Due to the noted condition, it is feasible to retain the existing hull structure and update the superstructure to accommodate a new propulsion system. In the marine industry, this kind of vessel repowering is common and is often done at a projected vessel mid-life, or between 10 and 20 years of operation. Depending on the overall lifespan and condition of a steel hulled vessel, one or two repowers are not uncommon. Note that for a typical repower it is unusual to replace the vessel superstructure. In this case, we are recommending a new superstructure to accommodate a new cable sheave arrangement and propulsion components, along with updated arrangements and fire suppression associated with battery electric diesel hybrid or all electric propulsion systems.

Preservation and reuse of the existing hull will present some challenges, however; as the location of the Merrimac Ferry may make this process more complex than a typical vessel overhaul or repower. Located in an area with no local shipyards or dry dock facilities, reuse will require the vessel to be hauled out at the Lodi terminal. Work on the vessel will be done in place. Once hauled out, the vessel will need to be put on blocks. The reasons for this are two-fold: 1) to provide access the under bottom of the hull to add sea chests and update the exterior coatings and 2) to level the main deck of the vessel to facilitate accurate installation of the cable sheaves, propulsion equipment, other auxiliary systems and new vessel superstructure.

We note that the existing vessel was delivered in three modules and assembled in place at Lodi prior to launching, so similar work in place has been done before. Haul out and refurbishment of the existing vessel will be similar, but with added complexity. Effective vessel haul out and docking methods will need investigation. Environmental considerations related to containment of blast media and removed paint will need to be considered. Temporary shelter may be necessary when considering battery installations in the hull. Cranes and other temporary equipment and infrastructure will be needed to remove and install equipment and vessel superstructure. Finally, while vessel launching has been done, undocking, or removal of the vessel support blocks is unique. Developing a build strategy that takes into consideration maximizing prefabrication and outfit of the vessel superstructure and minimizing the overall construction schedule for the vessel is out of the scope of this report but will be a useful component when comparing retention of the hull versus build a new vessel.

### 4.2.2 BUILD NEW VESSEL

The second option is to construct a new vessel off-site. Similar to the COLSAC III, a new vessel would be constructed in modules. The modules would be delivered and assembled onsite. This option would minimize the work at the Lodi terminal and maximize the work the amount of construction work in a shipyard that is set to manage environmental, infrastructure, safety, and labor availability concerns associated with vessel construction. The delivery of the vessel in modules, along with assembly and launching on site will require management of these same concerns as preserving the existing hull but on a smaller scale. A build strategy for construction, delivery and launch of a new vessel is beyond the scope of this report, but is a complementary component needed for comparison of these options.

## 4.3 PROPULSION OPTIONS

Utilizing the power profile and operational schedule discussed in Section 3, EBDG evaluated three different propulsion arrangements. System variations consider the use of a diesel engine, energy storage and shore power availability. The three different options selected provide a range of fossil fuel reliance and vessel availability. During the next phase of design these options can be refined for performance.

Each system description includes a simplified system schematic. Figure 4 is a key for all major components included in these diagrams.

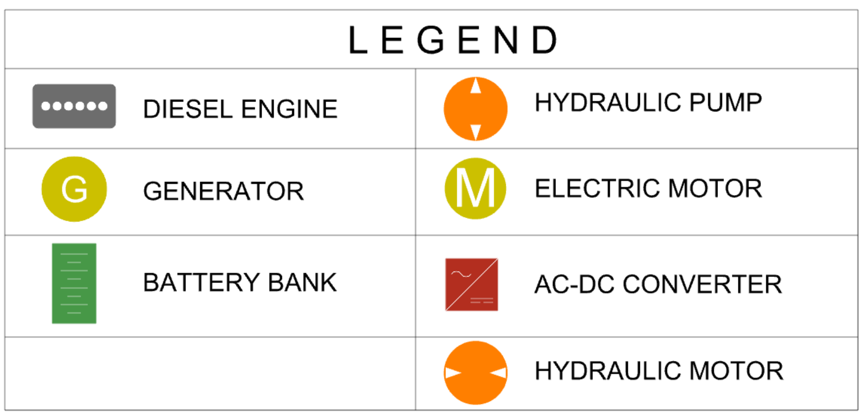



*Figure 4: System Schematic Key*

### 4.3.1 OPTION 1: DIESEL HYDRAULIC PROPULSION

The first propulsion system is a diesel hydraulic system. This option mirrors the existing system and is primarily used as a baseline for comparison. In this option, a diesel engine operates hydraulic pumps through an engine mounted power take off. The propulsion hydraulic pump pumps hydraulic fluid to a hydraulic motor which turns the drive sheave. A secondary hydraulic pump pressurizes the gate operating system at both ends of the vessel. The diesel engine also drives a generator to provide electric power for the vessel's hotel loads.

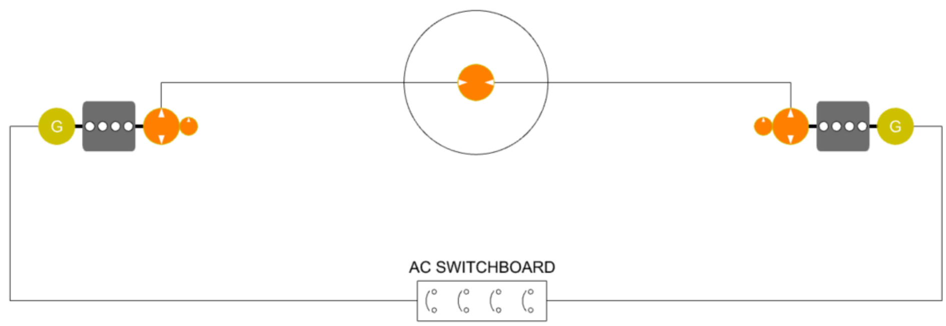



*Figure 5: Diesel Hydraulic Propulsion*

#### 4.3.1.1 EQUIPMENT

This option specifically considers the following equipment:

- 2 (ea) Cummins QSB6.7 diesel engines
- 4 (ea) Hydraulic Pumps
- 1 (ea) Hydraulic Drive Motor
- 2 (ea) 75kW generators
- 1 (ea) AC distribution panel
- 2 (ea) Wheelhouse human machine interfaces (HMI)

### 4.3.2 OPTION 2: HYBRID DIESEL ELECTRIC PROPULSION

The second option consists of one diesel engine, lithium-ion batteries, electric motors, and other electric drive and distribution equipment. The batteries store energy for propulsion, auxiliary demands and non-propulsion loads such as the ramp operation, ventilation and lighting loads.

This option uses an induction motor to operate drive sheaves via a reduction gear; propulsion hydraulics are eliminated. Two motors and reduction gears have been included for redundant backup.

This option is evaluated assuming shore charging is not available, and the diesel generator is used to charge the batteries. The option lends itself to future adoption of a zero-emission configuration by equipping the vessel with a charging receptacle and providing adequate shoreside charging infrastructure. The battery bank has been sized to allow for operation on exclusively batteries when fully charged similar to option 3.

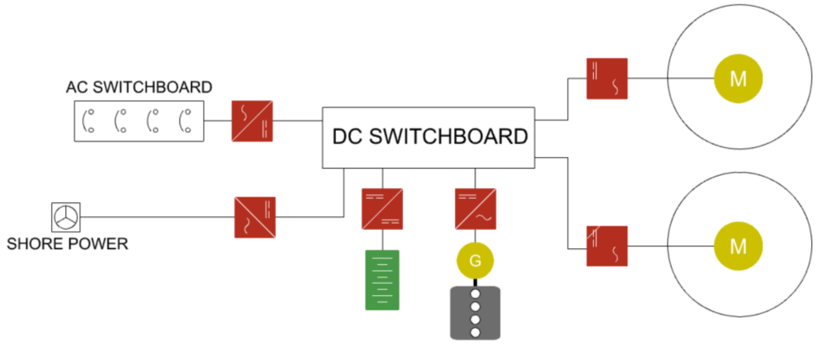



*Figure 6: Hybrid Diesel Electric Propulsion*

#### 4.2.2.1 EQUIPMENT

This options specifically considers the following equipment:

- 2 (ea) 150 kW Marelli Induction Motors
- 1 (ea) Cummins QSB6.7 diesel engine with Generator
- 2 (ea) Dana Right Angle Reduction Gears
- 888 kWh Corvus Dolphin Batteries
- 1 (ea) Canal Hybride PMS and Conversion Equipment
- 1 (ea) 480V SWBD
- 2 (ea) Wheelhouse HMI

### 4.3.3 OPTION 3: FULL ELECTRIC PROPULSION

The third option is a zero emissions electric propulsion system. As with Option 2, the vessel utilizes lithium-ion batteries to provide for propulsion and hotel loads. The batteries are charged via shoreside charging infrastructure. Initially, the batteries are sized for two hours of continuous operation, and a 20-minute layover period is required to recharge the batteries. As with the hybrid design the hydraulic system would be removed for this propulsion option and all systems would operate on electricity.

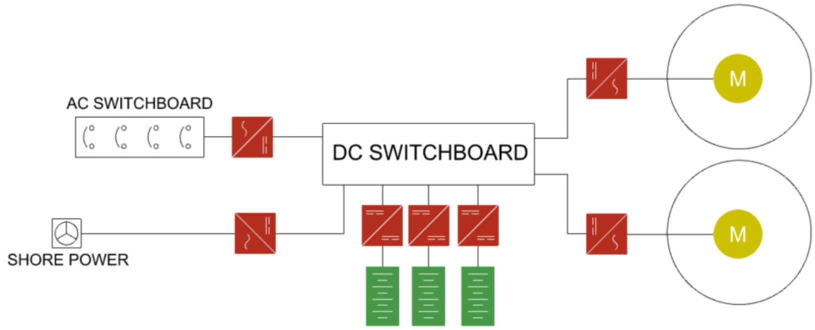



*Figure 7: Full Electric Propulsion*

#### 4.3.3.1 EQUIPMENT

- 2 (ea) 150 kW Marelli Induction Motors
- 2 (ea) Dana Right Angle Reduction Gears
- 888 kWh Corvus Dolphin Batteries
- 1 (ea) Canal Hybride PMS and Conversion Equipment
- 1 (ea) 480V SWBD
- 2 (ea) Wheelhouse HMI

# 5. DISCUSSION

Utilizing the power profile and operating schedule described in Section 3, this study examines how each of the different propulsion options will perform. As shown in Appendix A, these powering calculations include the determination of the power required for propulsion and hotel loads and the energy source utilized to meet the total demand.

## 5.1 FEASIBILITY

EBDG performed a feasibility assessment of each of the options primarily to determine whether the existing vessel could be repowered with new propulsion equipment and meet the required 25-year design life.

Options 2 and 3 are likely to have increased propulsion system weight as compared to Option 1 or the existing system. As such, EBDG developed a weight estimate of the existing hull structure and calculated the allowable displacement of the existing hull to determine if there is any capacity for increased system weights. While increased weight will cause the vessel to sit deeper in the water, EBDG determined that all three propulsion options are feasible with current vessel hull.

## 5.2 SYSTEM RELIABILITY

Reliability has been identified as a key priority for this vessel. Reliability for this assessment is the ability of a component or system to perform the required functions under stated conditions for a stated period without failure.

For this study a system or component failure is defined as a condition or issue that results in a delayed sailing. Both the all-electric and hybrid option introduce new electronic components into the operation, although these are unlikely to fail and the batteries are rated to last 10 years before replacement, repair may require specialized training or tooling. The selection and arrangement of the electrical components can be such that the propulsion redundancy is provided. For instance, the hybrid option currently assumes a single generator, an additional generator could be provided so serve as a backup.

The diesel hydraulic system with new updated hydraulic components should have improved reliability over the existing system but relies on a greater number of moving parts and components when compared to the electric and hybrid options. Any failures to this system are likely to be known and easily diagnosed by existing WisDOT staff. Option 1 and the existing installation provide a redundant engine for sustained operations when the opposite engine is under repair.

## 5.3 EASE OF MAINTENANCE

Ease of maintenance is a vital metric to track for these options due to the relative remote location of the Merrimac ferry. Systems with moving parts require more maintenance, thus reducing engine hours or the quantity of installed engines can be expected to reduce the maintenance burden of the system.

The current hydraulic system is problematic for the owner and maintenance team. The propulsion hydraulic system is over 20 years old, and the maintenance team reports that acquiring replacement components is difficult and that sourcing parts requires custom design. The installed equipment is not supported by the manufacturers and the design of the custom equipment is not well documented.

All propulsion options will improve upon the current system by providing "off the shelf" components which will ease repairs and support.

The diesel and hybrid options are based on the same engines as are currently installed on the COLSAC III, Cummins QSB7-DM, so the engine maintenance is expected to be similar to the current operation.

A new diesel propulsion system can be fit with an updated the hydraulic system with modern equipment allowing simplification of the system and ease of maintenance. It is recommended that this system be equipped with two separate hydraulic fluid reservoirs such that a failure in the gate system does not affect the propulsion system.

The hybrid option will eliminate the propulsion hydraulic system and replace it with electric motors. The hybrid option significantly reduces maintenance requirements than the diesel hydraulic option due to the reduced engine hours required for operation resulting in less wear on the system.

The all-electric system will require the least maintenance when in operation; however, it introduces reliance on service providers. It is advised that electric system integrators provide a window of response time estimates if this option is selected so that service lead times can be better understood.

The winterization process for a diesel hydraulic system is expected to be similar to the existing installation. Eliminating propulsion hydraulics for the hybrid and all-electric option should simplify the winterization process. Note, however, that lithium-ion batteries are likely to require heat over the winter to preserve battery life expectations.

The power profile calculations were used to determine when an engine is required to meet the propulsion and hotel power demands. The hybrid option, for example, does not require the engine to operate for 12 hours while the vessel is on standby. Table 1 is a summary of the expected annual engine hours for each option.

| Propulsion Option | Engine Hours |
|---|---|
| Diesel | 4980 |
| Diesel Electric Hybrid | 1530 |
| All Electric | 0 |

*Table 1: Annual Generator Hours*

## 5.4 SERVICE LEVELS

The COLSAC III currently operates on demand for 24 hours a day. Service levels are evaluated based on whether the new or modified vessel can maintain the current service level based on the potential number of trips per day and the dwell time requirements. The power profile calculations were used to determine the maximum number of trips the vessel can provide in a 12-hour operating period.

For the diesel propulsion system service levels will be the same as the existing operation with 96 one-way trips per 12-hour window with a 3-minute load and unload time on each side of the crossing.

The hybrid option, likewise, allows for continuous operation for a 12-hour period, capable of 96 one-way trips. After 2 hours of continuous operation on battery power, the diesel generator can provide propulsion and recharge batteries. The vessel can continue this schedule indefinitely as the batteries can charge while transporting passengers.

The all-electric option is the only option that introduces a layover period after 2 hours of operation, requiring a 20-minute pause in operation to recharge the batteries to full capacity. Including this 20-minute recharging time in the schedule reduces the quantity of one way trips to 87. This is a 9% reduction in service.

The 20-minute layover is based on shoreside improvements to provide 900 kW for charging. Various charging times and charging rates can be evaluated; however, per discussions with Aliant, 900 kW is likely the greatest available without major electric grid modifications.

## 5.5 CREWING NEEDS

Crewing can be the largest cost of operating the vessel. The COLSAC III is operated by one individual in the wheelhouse. From the wheelhouse, the operator can control the vessel and direct traffic with the hydraulic gates.

The crewing needs for both the hybrid and the diesel propulsion options will require the same number as currently used in operation.

The all-electric option may require an additional person on one side to plug in the vessel to shore power, or the layover time may be increased to allow the operator to leave the wheelhouse and perform this operation. This requirement may be overcome with an automated charging system.

## 5.6 ENERGY CONSUMPTION AND EMISSIONS

Energy consumption is a function of time at load and the associated energy use rate at that load. Utilizing the power profile described in Section 3, each option is evaluated over a 24-hour window, assuming 12-hours of continuous operation and 12-hours of standby. The power profile model for the hybrid and all electric options assumes that the vessel begins a 24-hour cycle with fully charged batteries.

The diesel hydraulic option and hybrid option results are reported in gallons of diesel burned while the all-electric option result is reported in electricity (kWh) required from shore power.

The diesel propulsion system requires that a diesel engine is running 24 hours per day and is thus expected to consume the greatest amount of fuel.

The hybrid option utilizes the batteries for energy storage, as a buffer, when the vessel is not operating. When the generator is running, the generator will run at a best efficiency point. This allows for reduced diesel consumption as compared to the diesel hydraulic option. The batteries in this option were sized to allow for 2 hours of continuous operation. After two hours of operation, the vessel will require the generator to come online. It is likely that the vessel can be on standby for 12 hours without requiring the generator.

Carbon dioxide is calculated using the Department of Transportation emissions rate of 10.18 grams of carbon dioxide per gallon of diesel fuel burned, reference [3]. The annual emissions and fuel consumption results are provided in Table 2 below, with diesel hydraulic consuming the most fuel and producing the having the highest level of emissions.

| Propulsion Option | Diesel Consumed (gal) | Carbon Dioxide (MT) |
|---|---|---|
| Diesel Hydraulic | 24,800 | 250 |
| Diesel Electric Hybrid | 23,100 | 240 |

*Table 2: Annual Fuel and Emissions Estimates*

The all-electric option has batteries sized for 2 hours of continuous operation and will then require a 20-minute layover to recharge the batteries. In 12 hours of continuous operation the vessel will recharge 6 times. The vessel will not require recharging during the 12-hour standby period; the vessel could optionally be plugged in during extended standby time. Table 3 below provides the estimated annual shore power electricity data. While this study does not address the cost of the shore power, it should be further investigated. Electricity rates typically depend on the amount of electricity required, in kilowatt hours (kWh) and the rate at which the electricity is required, in kilowatts (kW). Additionally, some providers have high demand charges for specific times, days, and months of the year.

| Propulsion Option | Shore power Consumed (kWh) | Shore power Rate (kW) |
|---|---|---|
| All Electric | 428,000 | 900 |

*Table 3: Annual Shore Power Estimate*

## 5.7 CAPITAL COST

EBDG compiled construction cost estimates for each of the propulsion options including variation on whether the existing hull is retailed, see reference [4].

## 5.8 SHORESIDE IMPROVEMENTS

Option 1 would continue with the current operation and not require shoreside modifications. Option 2 can start operation without immediate shoreside improvements and has the flexibility to be converted to fully electric propulsion. Option 3 will require shoreside improvements to be completed prior to the start of service with the new or refurbished vessel. If shoreside modifications are required, the overall cost and timeline of the project is expected to increase.

When considering the all-electric option and conversion from the hybrid option, shoreside infrastructure improvements should be evaluated in parallel to capture the full cost implications as well as any refinements to be made on the vessel related to added weight or changes in displacement. Within the scope of this report, the all-electric option is the only system that requires shoreside improvements to support operations. Manual versus automated charging systems are not evaluated as part of this report. These systems should be evaluated in the next phase, taking into consideration elements such as capital costs, impact on crewing, and charging system maintenance and reliability, when working toward final propulsion system option selection.

# 6. REFERENCES

[1] Elliott Bay Design Group, "COLSAC III Vessel Inspection Report," 2024.

[2] Elliott Bay Design Group, "23112-02M, Rev B Emissions Evaluation," 2024.

[3] Enviromental Protection Agency, National Highway Traffic Safety Administration, *Federal Register, Vol. 75, No. 88,* 2010.

[4] Elliott Bay Design Group, "23112-04M Vessel Alternative Construction Cost Estimates," 2024.

# ENVIRONMENTAL REVIEW MEMO

## Appendix E

# MEMO

*Date:* November 2024

*To:* Wisconsin Department of Transportation

*From:* KPFF Consulting Engineers

*Subject:* Merrimac Ferry Performance and Reliability Improvement Study
Environmental Review

## 1 PURPOSE

Wisconsin Department of Transportation (WisDOT) is conducting the Merrimac Ferry Performance and Reliability Improvement Study to develop concepts that improve service reliability, reduce vessel emissions, and meet the needs for all modes of travel for both the short- and long-term future of this ferry service. The Study includes the following tasks:

- Assess and document the existing conditions of the *Colsac III* and the Merrimac Ferry landings.
- Review the current operation and maintenance procedures of the ferry service.
- Analyze design concepts (projected to the design year 2050) for future ferry operations and provide detailed recommended concepts for future study.
- Provide recommendations for short-term improvements to the service, operations, and maintenance of the Merrimac Ferry.
- Document study findings to guide the department on future decisions.

This memo provides an overview of existing service and concepts to be considered, identifies the likely class of National Environmental Policy Act (NEPA) action , reviews key environmental considerations for the project, and identifies next steps needed to support the environmental review process.

## 2 OVERVIEW OF EXISTING SERVICE

The Merrimac Ferry traverses the Wisconsin River between Columbia and Sauk Counties, linking Wisconsin Highway 113 between Okee and Merrimac, as shown in Figure 1. The ferry transports vehicles, pedestrians, motorcycles, and bicycles on the approximately four-minute, half-mile crossing. The ferry has operated as a free crossing since 1933, when the state took over operations of the service.

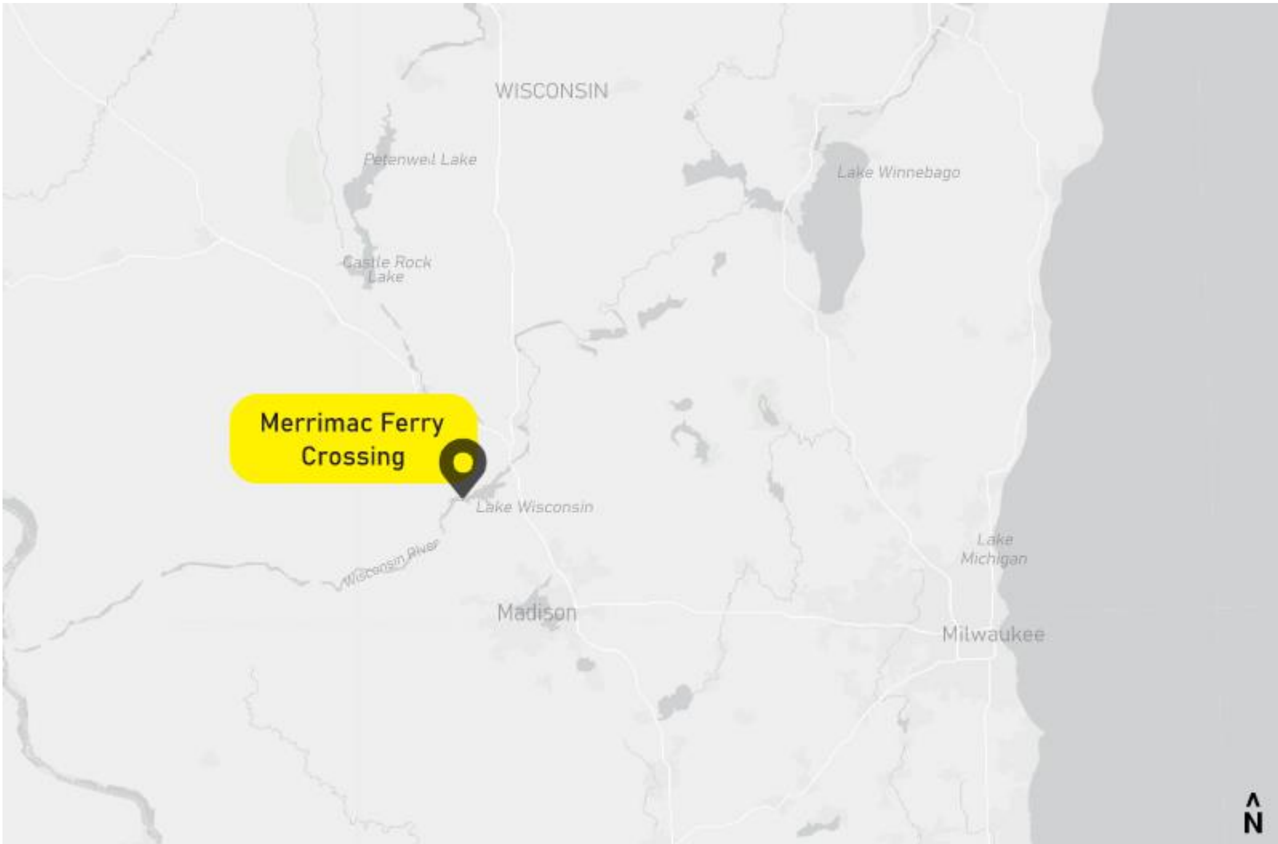



***Figure 1: Merrimac Ferry Crossing Location***

The current ferry carries up to 15 standard-size vehicles. Standard single-rear-axle trucks and tow-behind campers are permitted on board, depending on their maneuverability, with a maximum weight limit of 16 tons per vehicle and a maximum of two axles.

# 3 SUMMARY OF CONCEPTS

Based on the project purpose and need, five potential concepts have been identified for future Merrimac ferry service. All concepts assume that both ferry landings will remain in their current locations. Because the current vessel capacity and service level is anticipated to meet future demand, the concepts assume the current vessel size and terminal footprint.

The concepts fall into two categories of vessel improvements. The first category includes concepts that preserve and maintain the *Colsac III* while making certain improvements to meet project goals. The second category involves design and construction of a new vessel to replace the *Colsac III*. Vessel alternatives are summarized in Table 1.

***Table 1: Summary of Concepts***

| No. | Concept Name | Vessel Improvements | Shoreside Improvements |
|---|---|---|---|
| ***Colsac III* Preservation**<br>*Keep the existing vessel hull and update or replace the propulsion and other systems* | | | |
| **1** | Vessel Repower (Diesel) | Add new hydraulics and safety updates | Limited |
| **2** | Propulsion System Replacement (Diesel-Electric Hybrid) | Replace the existing diesel engines with new hybrid diesel-electric propulsion and house. Onboard batteries will be charged by diesel system without shoreside charging. | Limited |
| **3** | Propulsion System Replacement (All Electric) | Replace the existing diesel engines with new all-electric propulsion and house | Installation of electrical charging equipment and associated electrical improvements |
| **New Vessel Concepts**<br>*Design and construct a new vessel* | | | |
| **4** | New Diesel-Electric Hybrid Vessel | New vessel with hybrid diesel-electric propulsion system. Onboard batteries will be charged by diesel system without shoreside charging. | Limited |
| **5** | New All Electric Vessel | Purchase a new vessel that is all-electric and has no diesel engines | Installation of electrical charging equipment and associated electrical improvements |

## 3.1 Summary of Shoreside Improvements

Conceptual improvements are focused mainly on the vessel with uplands work limited to potential operational enhancements such as installation of signage. However, Concepts 3 and 5 require more significant landing site improvements to support shoreside electric vessel charging. While this assessment assumes that the two diesel-electric hybrid vessel alternatives, Concepts 2 and 4, would be designed to charge onboard batteries from a diesel generator on the vessel, both concepts could be designed to be compatible with future shoreside charging to take advantage of long-term electrical grid improvements.

Figure 2 provides a conceptual layout and estimated footprints for equipment required to support shoreside electric vessel charging, including Megawatt Charging System (MCS) components near the dock, and electrical transformer, metering, and cooling systems uplands near the maintenance shed. Additionally, site improvements would be needed to bring the required power to the site.

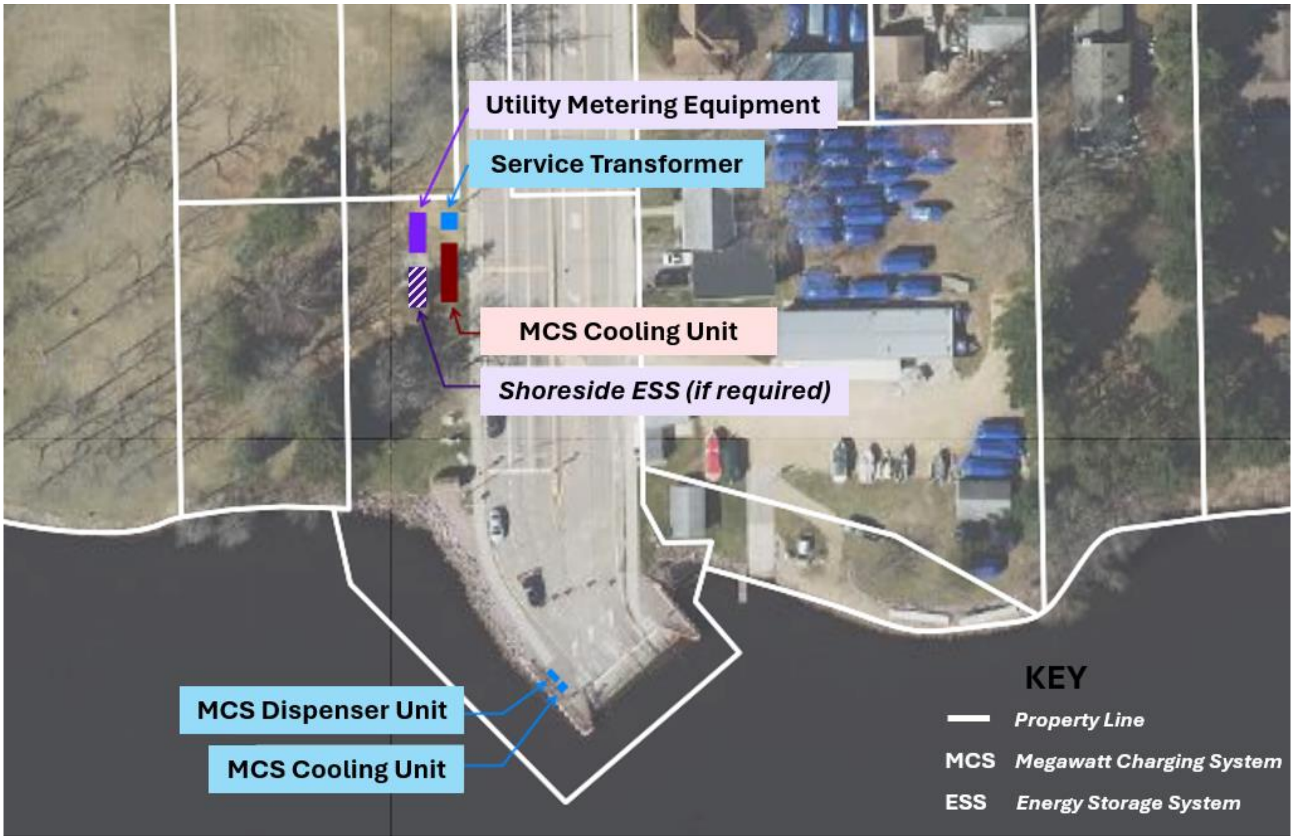



***Figure 2: Conceptual Vessel Charging Equipment Layout***

As shown in Figure 2, an MCS charging dispenser is required near the vessel landing to provide electrical charging connection to the ferry. This equipment must be located within a certain distance from the vessel charging receptacle, based on cable length restrictions. Preliminary design anticipates that this equipment could be located on the existing pedestrian area adjacent to the vessel landing, highlighted in Figure 3, without requiring in-water construction of additional structures. This assumption will need to be validated in future design phases.

**Figure 3: Conceptual Location for MCS Charging Equipment**

# 4 FRAMEWORK FOR FUTURE ENVIRONMENTAL REVIEW

The following sections outline the anticipated class of action for project alternatives, as well as environmental considerations for future assessment of alternatives.

## 4.1 NEPA/WEPA

To comply with potential future federal and state funding requirements, the project will be required to complete National Environmental Policy Act (NEPA) and state Wisconsin Environmental Policy Act (WEPA) processes. Using the NEPA process, agencies evaluate the environmental and related social and economic effects of their proposed actions. Agencies also provide opportunities for public review and comment on those evaluations.

The environmental review under NEPA and WEPA can involve three different levels of analysis:

1. Categorical Exclusion (CE): Prepared for actions which do not have a significant environmental effect.
2. Environmental Assessment/Finding of No Significant Impact (EA/FONSI): Preparation of an EA is required for actions in which the significance of environmental impacts is not clearly established. The EA process either results in a FONSI if no significant impacts are found, or leads to preparation of an EIS.
3. Environmental Impact Statement (EIS): Prepared for actions which significantly affect the environment.

The NEPA and the WEPA set forth the environmental policy framework that WisDOT would comply with to complete this project. Upon reviewing the Code of Federal Regulations (CFR) language, it appears that all alternatives for this project would typically qualify for a Categorical Exemption (CE), as the project does not involve significant impacts, as outlined by 23 CFR 771.117(a), and it meets the defined categorical exemptions per 23 CFR 771.117.c.29 & 23 CFR 771.117.c.30.

Because the crossing is listed on the National Register of Historic Places, the project will also complete the Section 106 review process to identify and assess potential impacts to the historic property. The Section 106 process is coordinated with NEPA, and the project will only qualify for a CE designation if it is documented that no significant effects to historic properties will result from the project. If the project is found to have an adverse effect on the historic property, it may require a higher level of environmental review.

**23 CFR 771.117.c.29**

*"Purchase, construction, replacement, or rehabilitation of ferry vessels (including improvements to ferry vessel safety, navigation, and security systems) that would not require a change in the function of the ferry terminals and can be accommodated by existing facilities or by new facilities that themselves are within a CE."*

**23 CFR 771.117.c.30**

*"Rehabilitation or reconstruction of existing ferry facilities that occupy substantially the same geographic footprint, do not result in a change in their functional use, and do not result in a substantial increase in the existing facility's capacity. Example actions include work on pedestrian and vehicle transfer structures and associated utilities, buildings, and terminals."*

Early coordination with the lead federal agency responsible for NEPA compliance, and the State Historic Preservation Office (SHPO) is recommended to coordinate approach for Section 106 review and understand the likely class of action for NEPA review.

# 5 ENVIRONMENTAL CONSIDERATIONS OF ALTERNATIVES

While detailed assessment of project alternatives will be completed in a future project phase, key environmental impacts to be considered in assessment of alternatives are outlined below under four main categories: Economic, Social and Cultural, Natural, and Physical.

## 5.1 Economic

***Transportation Impacts***

The Merrimac Ferry crossing is a major connector on WIS Highway 113 between Lodi and Merrimac, as well as U.S. Bike Route 30. Terminal construction activities will likely cause temporary disruptions in the ferry transportation connection, impacting local businesses, residents, and regional tourism. The vessel may be out of service during other periods of the project as well (i.e., vessel refurbishment or new vessel assembly). These impacts will be mitigated as much as is feasible and should disappear following project completion.

*For alternatives that require shoreside electric charging,* transportation impacts will likely be more significant as ferry service schedules may need to change to accommodate charging times, but overall service levels are not expected to significantly decrease. Detailed service impacts will be better understood and quantified during the design process.

## 5.2 Social and Cultural

***Historic Resources / Section 106***

The Merrimac Ferry crossing has served customers for 180 years, with operations beginning in 1844. The crossing site, defined as State Highway 113 at the Wisconsin River, was designated as a historic place in the National Register of Historic Places in 1973.

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Section 106 of the National Historic Preservation Act of 1966 (NHPA) requires federal agencies to consider the effects on historic properties of projects. The project will coordinate closely with the State Historic Preservation Office (SHPO), as well as other potential interested parties such as Sauk County Historical Society and Columbia County Historical Society, to ensure the appropriateness of the final vessel alternative and any necessary terminal improvements to support it. Potential mitigation under Section 106 may include preservation and display of historic ferry crossing elements.

### *Tribal Coordination*

The Merrimac Ferry is not located on any tribal lands. Future project phases will include outreach to the Ho-Chunk Nation and other area tribes to provide project information and invite feedback.

### *National Ice Age Scenic Trail*

As the ferry serves as segment of the National Ice Age Scenic Trail, trail impacts will need to be considered temporary service disruptions that create transportation impacts will also impact the trail, as the vessel may be out of service during periods of the project. These impacts will be mitigated as much as is feasible and should disappear following project completion.

Coordination with National Park Service in future project phases will be needed to understand desired project elements such as installation of interpretive signage.

## 5.3 Natural

Future environmental review will include assessment of project effects on natural resources in the project area such as those listed below. While none of the potential alternatives include major in-water or uplands improvements, alternatives which include installation of shoreside electrical charging equipment and associated site upgrades include a higher level of potential impacts to be considered in future alternatives assessment.

### *Rivers, Streams and Floodplains*

The project area is located on Lake Wisconsin, and within a mapped floodplain.

### *Threatened or Endangered Species*

A total of seven threatened, endangered, or candidate species are listed in the vicinity of the project. These include:

Threatened Species
- Northern Long-eared Bat
- Mead's Milkweed
- Northern Wild Monkshood
- Prairie Bush-clover

Endangered Species
- Higgins Eye (Pearly Mussel)
- Sheepnose Mussel

Experimental Population
- Whooping Crane

No critical habitats are known to be within the ferry project area, but a biological surveys will need to be conducted to determine potential impacts on identified species and potential mitigation, such as relocation of endangered species during construction activities.

## 5.4 Physical

### *Emissions*

Alternatives for this project will result in a long-term decrease in air emissions, though a temporary increase in emissions may result from construction equipment used onsite in the construction/delivery of necessary terminal improvements such as electrical distribution equipment and battery banks.

*For alternatives that utilize shoreside electric charging,* assessment of emissions reduction may be informed through coordination with utility providers to understand near- and long-term plans for transition to clean energy sources.

### *Noise*

The current ferry's diesel engines create noise, and new ferry vessel alternatives are anticipated to either maintain that level of noise or decrease it. Temporary increases in noise will likely result from construction activities needed to update terminals to support electric operations, but landside noise should resume to normal levels following construction completion.

### *Grading and Soil*

For potential electric vessel alternatives with shoreside charging, terminal improvements to support electrification may involve some movement of soils. For all potential alternatives, future design phases will confirm construction impacts from on-site vessel refurbishment or construction. Assessment of alternatives will consider project impacts, as well as potential best management practices (BMPs) to minimize any negative effects from soil loss or sediment transport that may occur. A Phase 1 Environmental Site Assessment may be conducted to identify any contaminated soils at the landings.

# 6 NEXT STEPS

The next phase of the Merrimac Ferry Performance and Reliability Improvement Study will build upon the findings from identification and initial review of project concepts in Phase 1. Phase 2 is anticipated to include the following elements.

### *Preliminary Design*

Immediate next steps for this project include further definition of the scope of alternatives for environmental review. Vessel alternatives and associated shoreside improvements will be advanced to a preliminary design level to inform assessment and comparison of alternatives, including both short and long-term project effects. While conceptual design indicates that no in-water structural work is anticipated as part of this project, further design work is needed to confirm that is the case for all alternatives.

### *Public and Stakeholder Engagement*

Engagement with the public and key stakeholders will be conducted to gather feedback on project alternatives to inform project design and identify potential impacts and concerns. Engagement efforts will target key audiences such as:

- Merrimac Ferry users
- Columbia County and Sauk County residents
- Businesses located near ferry landings
- Tourism groups
- Bicycle organizations interested in U.S. Bike Route 30
- National and State Parks users
- Local officials

### *Agency Coordination*

Following this scope definition, initial outreach with regulatory agencies including U.S. Army Corps of Engineers (USACE), the U.S. Fish and Wildlife Service (USFWS), U.S. Environmental Protection Agency (EPA), Wisconsin Department of Natural Resources, State Historic Preservation Office (SHPO), and National Parks Service is recommended to verify permitting needs and identify initial concerns and potential project impacts.

Terminal improvements to support charging are anticipated to occur at the northern landing and will require coordination with Columbia County Planning & Zoning to verify the final permitting needs of the selected alternative and as part of the permit application and review process.

### *Utilities Coordination*

Ongoing coordination with Alliant Energy will be critical throughout planning and design for alternatives that include shoreside electric vessel charging. Alliant Energy will be a key partner in coordinating the project with near- and long-term local energy improvements, as well as pursuit of funding opportunities for project alternatives that include an emissions reduction component.

# FUNDING OPPORTUNITIES MEMO

## Appendix F

| | |
|---|---|
| Date: | October 9, 2024 |
| To: | Wisconsin Department of Transportation |
| From: | KPFF Consulting Engineers |
| Subject: | Summary of Funding Opportunities |

# 1 PURPOSE

Wisconsin Department of Transportation (WisDOT) is conducting the Merrimac Ferry Performance and Reliability Improvement Study to develop alternative concepts that improve service reliability, reduce vessel emissions, and meet the needs for all modes of travel for both the short- and long-term future of this ferry service. The Study includes the following tasks:

- Assess and document the existing conditions of the *Colsac III* and the Merrimac Ferry landings.
- Review the current operation and maintenance procedures of the ferry service.
- Analyze short and long-term alternative design solutions (projected to the design year 2050) for future ferry operations and provide detailed recommended alternatives for future environmental study.
- Provide recommendations for short-term improvements to the service, operations, and maintenance of the Merrimac Ferry.
- Document study findings to guide the department on future decisions.

This memo provides a summary of potential federal and state grant funding opportunities for Merrimac Ferry operating and capital costs.

# 2 SUMMARY OF FUNDING OPPORTUNITIES

## 2.1 Federal Grant Opportunities

Numerous federal funding opportunities are available to support transportation investments. Currently, many of these opportunities are part of the Justice40 initiative which aims to have 40% of certain federal investments flow to communities that are overburdened by pollution and have been marginalized by underinvestment.[1] Specifically applicable communities are defined per funding opportunity, though a common mapping tool used to identify them is the Climate and Economic Justice Screening Tool (CEJST). Though not all federal funds need to flow to these communities, applications that serve Justive40 communities will be more competitive. Per CEJST, the Merrimac Ferry is not located in a disadvantaged community which may impact the competitiveness of this project's federal grant applications for Justice40 programs.

[1] https://www.whitehouse.gov/environmentaljustice/justice40/

Additionally, for emissions reduction projects, higher volumes of emissions reductions are more competitive for grants like the FTA Electric or Low Emitting Ferry Pilot Program or the USDOT Carbon Reduction Program. For these specific opportunities, the electric ferry alternatives would decrease ferry emissions the most and thus likely be the most competitive for receiving funding.

*Table 1* below provides a list of federal funding opportunities that could be used to support the Merrimac ferry project. Key opportunities where the project may be most competitive have also been specifically identified.

*Table 1- List of Federal Funding Opportunities*

| Agency | Grant/Strategy | Overall Assessment | Key Opportunity |
|---|---|---|---|
| FHWA | Surface Transportation Block Grant Program (STP) | Not a typical funding source for ferry projects and likely limited to shoreside projects | |
| FHWA | Construction of Ferry Boat and Ferry Terminal Facilities Program | Reliable but low-level funding traditionally for capital projects | ✓ |
| FHWA | Transportation Alternatives Program (TAP) | Not a typical funding source for ferry projects and likely limited to connecting infrastructure. | |
| FHWA | Charging and Fueling Infrastructure (CFI) | Charging infrastructure must be publicly accessible; Merrimac Ferry project would not be eligible for funding. | |
| FTA | Passenger Ferry Grant Program – Section 5307 | Merrimac Ferry may not be a direct recipient and may not be located within an urbanized area. | |
| FTA | Electric or Low Emitting Ferry Pilot Program | The Merrimac Ferry would be eligible if an all-electric or hybrid ferry alternative is selected. | |
| FTA | Ferry Service for Rural Communities Program- 71103 | Merrimac Ferry does not meet eligibility requirements of a rural ferry service. | |
| FTA | State of Good Repair– Section 5337 | Funding geared toward urbanized areas between 50,000 – 200,000 population. | |
| USDOT | Rebuilding America Infrastructure with Sustainability and Equity (RAISE) Grants | High potential funding award. Requires support of elected leaders and the FHWA regional office and a well-developed application targeting priority criteria | ✓ |
| USDOT | Nationally Significant Multimodal Freight & Highway Projects (INFRA) | Route does not meet eligibility requirements | |
| USDOT, MARAD | Port Infrastructure Development Program (PIDP) Grant | This funding has previously been used for ferry facility improvements. Some consideration is available for small ports, though it is uncertain how competitive the small ferry crossing will be in this category. | ✓ |
| USDOT | Strengthening Mobility and Revolutionizing Transportation (SMART) | Funding is geared toward demonstration projects focused on new technologies. Vessel replacement is likely an ineligible activity. | |
| USDOT | National Infrastructure Project Assistance (Mega) program | Funding to support large and complex projects that are challenging to fund through other avenues. Due to the scale of the Merrimac Ferry project, it is unlikely that it would qualify for Mega program funding. | |

## 2.2 State Opportunities

Some federal funding is administered at the state level while other funding opportunities may be available for the ferry from other Wisconsin state agencies.

*Table 2- List of State Funding Opportunities*

| Agency | Grant/Strategy | Overall Assessment | Key Opportunity |
|---|---|---|---|
| FHWA | Congestion Mitigation and Air Quality (CMAQ) | Merrimac Ferry is eligible, but the Ferry may not compete well with projects in urban areas | |
| FHWA | Carbon Reduction Program (CRP) | This grant could provide potential funding for any carbon- | |

| | | | |
|---|---|---|---|
| | | reducing improvements with the ferry infrastructure. | |
| DNR | Recreational Trails Program (RTP) | Merrimac Ferry's eligibility for this funding is uncertain. | |

A more detailed summary of these federal and state opportunities is included in *Section 3-Detailed Catalogue of Funding Options* which is organized by funding agency.

# 3 DETAILED CATALOGUE OF FUNDING OPTIONS

## 3.1 Federal Highway Administration (FHWA) Opportunities

### 3.1.1 Surface Transportation Block Grant Program (STP)

The program from the Bipartisan Infrastructure Law, STP is the most flexible of FHWA aid programs and can be used to fund a wide range of programs including transit capital projects. One subdivision of the STP is most applicable for Merrimac, the STP-Rural Program. STP grants are federal block grants with funding allocated to states based on a formula. STP funds cannot be used as a reoccurring revenue source.

***STP-Rural/STP-R (https://wisconsindot.gov/Pages/doing-bus/local-gov/astnce-pgms/highway/stp-rural.aspx)***

Provides funding to improve roads and streets in rural areas functionally classified as principal arterial, minor arterial or major collector.

| Allowable Expenditures | Potential Yield | Timing | Assessment |
|---|---|---|---|
| Capital and cost-effective preventative maintenance.<br>Ideal for terminals | Variable; allocated locally and regionally by statutory formula. Funds awarded on a competitive regional and county basis.<br><br>***Estimated Yield***<br>Unknown | Competition is opened every three years.<br><br>STP-R FFY 2024-2029 program cycle deadline was October 2023 | **OVERALL ASSESSMENT**<br>Not a typical funding source for ferry projects and likely limited to shoreside projects<br>***Opportunities***<br>• Approach roadways for ferry terminals are eligible.<br>• Part of major highway provides possibility for interpretation to be allowable as marine highway system.<br>***Challenges***<br>• Allocated by population-based statutory formula.<br>• Does not fund operating expenses.<br>• May compete with other regional transportation projects.<br>• Historically, ferry projects have not received significant funding from STP. |

### 3.1.2 Construction of Ferry Boat and Ferry Terminal Facilities Program *KEY OPPORTUNITY*

This program was established to fund the construction of ferry boats and ferry terminal facilities based on a statutory formula and could provide a potentially reoccurring revenue source. The program requires the ferry service to be included in the biennial National Census of Ferry Operators.

| Allowable Expenditures | Potential Yield | Timing | Assessment |
|---|---|---|---|
| Design and construction of ferry vessels;<br>Design and acquisition of right-of-way,<br>Construction of terminal facilities;<br>Operational funding and connecting transit infrastructure in some cases | Variable; funds allocated by statutory formula based on service and operating variables reported through National Census of Ferry Operators at the Bureaus of Transportation Statistics<br>***Program Funding Available***<br>• 2025 - $184M<br>• 2026 - $186M | Funds distributed annually | **OVERALL ASSESSMENT**<br>Reliable but low-level funding traditionally for capital projects. Due to its reliability, this program has been identified as a key opportunity for the Merrimac Ferry.<br>***Opportunities***<br>• Dedicated ferry grant program<br>***Challenges***<br>• Limited national funding level distributed by formula without consideration of specific project need |

### 3.1.3 Transportation Alternatives Program (TAP)

Unlikely that this opportunity would apply to this ferry project but could be explored as the route serves as a connector to state bike routes and the regional Ice Age Trail.

| Allowable Expenditures | Potential Yield | Timing | Assessment |
|---|---|---|---|
| Projects that meet eligibility for Safe Routes to School Program, Transportation Enhancements, and/or the Bicycle & Pedestrian Facilities Program. | Unknown | 2024-2028 program cycle deadline was October 2023. | **OVERALL ASSESSMENT**<br>Not a typical funding source for ferry projects and likely limited to connecting infrastructure.<br>***Opportunities***<br>• Approach roadways for ferry terminals are eligible.<br>***Challenges***<br>• Allocated by population-based statutory formula |

### 3.1.4 Charging and Fueling Infrastructure (CFI)

This program supports the installation of charging infrastructure, but it requires that charging infrastructure be publicly accessible and available for public use without restriction. Currently proposed ferry charging infrastructure would not meet this need, and the CFI competition is likely not applicable for this ferry project.

## 3.2 Federal Transit Authority (FTA) Opportunities

### 3.2.1 Passenger Ferry Grant Program – Section 5307

The Passenger Ferry Grant Program provides competitive funding for projects that support passenger ferry systems in *urbanized* areas and are direct recipients of Section 5307 funds. This grant cannot be a source of recurring revenue.

| Allowable Expenditures | Potential Yield | Timing | Assessment |
|---|---|---|---|
| Capital expansion replacement, or rehabilitation of ferries, terminals, and related infrastructure; related equipment providing passenger ferry service | Variable funds awarded on a competitive basis.<br>In 2023 $50.1M is available for the Passenger Ferry Program<br><br>***Estimated Yield***<br>$2.5 million or more depending upon project | The 2023 call for projects was issued in May 2023 | **OVERALL ASSESSMENT**<br>Merrimac Ferry may not be a direct recipient and may not be located within an *urbanized* area.<br>***Opportunities***:<br>• Can be used for vessels and terminals<br>***Challenges***<br>• Does not fund operating expenses, planning studies, or preventative maintenance<br>• Vehicle-carrying ferries may not be eligible |

### 3.2.2 Electric or Low Emitting Ferry Pilot Program

Established by the Bipartisan Infrastructure Law, this competitive program supports the purchase of electric or low-emitting ferries and the electrification of or other reduction of emissions from existing ferries.

| Allowable Expenditures | Potential Yield | Timing | Assessment |
|---|---|---|---|
| Capital projects including purchase of electric or low-emitting ferry vessels and related infrastructure | Variable funds awarded on a competitive basis.<br>$50 million is available annually in 2025 and 2026.<br><br>***Estimated Yield***<br>Likely greater than >$1 million | The 2024 NOFO came out in April. | **OVERALL ASSESSMENT**<br>Could be applicable if an all-electric or hybrid ferry is selected. All-electric may be more competitive, though large emissions reductions will be most important for competing federally.<br>***Opportunities***:<br>• Can be used for vessels and terminals<br>***Challenges***<br>• Requires all-electric or hybrid vessel selection<br>• Will be competing with ferry systems nationwide that may have higher emissions reductions and/or serve low-income and disadvantaged communities. |

### 3.2.3 Ferry Service for Rural Communities Program- 71103

Though ferry specific, Merrimac Ferry would not qualify for this federal program as its service does not meet minimum requirements for route segment length.

### 3.2.4 State of Good Repair– Section 5337

Section 5337 funding provides capital assistance for maintenance, replacement and rehabilitation of fixed guideways including ferry service. This funding can be a recurring revenue source.

| Allowable Expenditures | Potential Yield | Timing | Assessment |
|---|---|---|---|
| Capital project expenditures for replacement and rehabilitation | Formula based on route miles | Distributed annually | **OVERALL ASSESSMENT**<br>Funding geared toward urbanized areas between 50,000 – 200,000 population.<br>***Opportunities***<br>• Can be used for capital project costs for vessels and terminals.<br>***Challenges***<br>• Does not fund operating expenses, planning studies, or preventative maintenance. Funding is geared toward urbanized areas. |

## 3.3 US Department of Transportation Opportunities

### 3.3.1 Rebuilding America Infrastructure with Sustainability and Equity (RAISE) Discretionary Grants *KEY OPPORTUNITY*

Established in the 2022 Bipartisan Infrastructure Law the RAISE grant program funds transportation infrastructure investments for FY 2024-2028. This is the successor discretionary grant program to BUILD and TIGER, but these funds cannot be used as a recurring revenue source.

| Allowable Expenditures | Potential Yield | Timing | Assessment |
|---|---|---|---|
| Construction and planning *Surface* transportation projects with significant local or regional impact including ferry vessels and terminals | Variable with funds awarded on a competitive basis capped by appropriations levels in the five-year Federal Transportation Appropriation Act.<br>$1 million minimum for rural capital projects.<br>The maximum is $2 million<br><br>***Estimated Yield***<br>Unknown | Five-year funding cycle with annual grant submissions | **OVERALL ASSESSMENT**<br>Will require support of elected leaders and the FHWA regional office and a well-developed application targeting priority criteria. Although highly competitive, RAISE has been awarded to similar ferry projects and is a key opportunity for this project.<br>***Opportunities***<br>• Potential for high funding level through 2028 and may be renewed through future federal transportation acts<br>***Challenges***<br>• Current grants must be obligated by September 2028 and expended by 2033, but the funding source may be renewed in future years<br>• Project must be targeted to meet merit criteria and scoring rubric |

### 3.3.2 Nationally Significant Multimodal Freight & Highway Projects (INFRA) Program

INFRA supports multimodal freight and highway projects of national or regional significance to improve the safety, accessibility, efficiency, and reliability of the movement of freight and people in and across rural and urban areas.

| Allowable Expenditures | Potential Yield | Timing | Assessment |
| --- | --- | --- | --- |
| Capital project expenditures for replacement and rehabilitation of port facilities | Max of $125 million<br><br>***Estimated Yield***<br>Unknown | x | OVERALL ASSESSMENT<br>Route does not meet eligibility requirements<br>*Opportunities*<br>• Funding for freight and highway projects<br>*Challenges*<br>• Route does not meet eligibility requirements |

### 3.3.3 Port Infrastructure Development Program (PIDP) Grant *KEY OPPORTUNITY*

The PIDP grant provides funding for projects that improve the safety, efficiency, or reliability of the movement of goods into, out of, around, or within ports, including the improvement of facilities within, or outside of and directly related to operations of, or an intermodal connection to, coastal seaports, inland river ports, and Great Lakes ports.

| Allowable Expenditures | Potential Yield | Timing | Assessment |
| --- | --- | --- | --- |
| Capital project expenditures for replacement and rehabilitation of port facilities | Max of $125 million<br><br>***Estimated Yield***<br>Unknown | FY 2024 applications called for late December 2023 and due May 2024 | **OVERALL ASSESSMENT**<br>Has previously been used for ferry facility improvements. Though it is unclear how competitive this project would be within the small ferry/port set aside portion of this grant, PDIP has been identified as a key opportunity for this project.<br>***Opportunities***<br>• Funding can be applied for most capital expenses that cover improvements in infrastructure in relation to the movements of freight, including ferry facilities.<br>***Challenges***<br>• Does require a BCA (benefit-cost-analysis) but if the project is small enough this may not be required. As a small ferry, unsure of competitiveness within the small port category. |

### 3.3.4 Strengthening Mobility and Revolutionizing Transportation (SMART)

The SMART program provides funding to conduct innovative projects on advanced smart community technologies systems to improve transportation efficiency and safety. However, both stages of this program have closed. Additional Stage 2 funding may be allocated, but Merrimac Ferry would be ineligible as it was not a Stage 1 funding awardee.

### 3.3.5 National Infrastructure Project Assistance (Mega) program

The Mega program supports large and complex projects that are challenging to fund through other avenues. Projects are meant to generate economic, mobility, or safety concerns. Due to the scale of the Merrimac Ferry project, it is unlikely that it would qualify for Mega program funding.

## 3.4 State Funding Opportunities

### 3.4.1 Congestion Mitigation and Air Quality (CMAQ) Program

This program provides federal funding for transportation projects and programs to help meet the requirements of the Clean Air Act. As a formula program, funding is allocated to states and MPOS to then award to projects. WisDOT administers these funds. Projects funded by CMAQ grants help reduce carbon emissions as well as emissions of criteria air pollutants like particulate matter and carbon monoxide. Funds from this program could not be a reoccurring source of revenue for the ferry.

| Allowable Expenditures | Potential Yield | Timing | Assessment |
|---|---|---|---|
| Transportation projects and programs that serve to reduce traffic congestion and improve air quality. | Variable, funds allocated by statutory formula and then awarded on a competitive basis.<br>***Estimated Yield***<br>Unknown (Capital projects must be $200,000+ and planning $50,000+)<br>***Previous Funding Totals***<br>• 2018 - $18M<br>• 2020 - $33M<br>• 2022 - $24M<br>• 2023 - $24M | 4-year funding cycle with bi-yearly application | **OVERALL ASSESSMENT**<br>Merrimac Ferry appears eligible, but the Ferry may not compete well with projects in urban areas<br>***Opportunities***<br>• Can be used to fund both capital costs and limited operating costs for eligible new or expanded transportation services.<br>• Can be used for modernization or rehabilitation on a marine highway corridor or crossing it functionally connected to the Federal-aid highway system<br>***Challenges***<br>• May compete with other traditional local transportation projects<br>• Eligibility is questionable with results needing to be produced in Wisconsin air quality nonattainment and maintenance areas (counties): Doors, Kenosha, Kewaunee, Manitowoc, Milwaukee, Ozaukee, Racine, Sheboygan, Walworth, Washington, & Waukesha<br>• Reimbursement program – needs Project Sponsor for upfront costs |

### 3.4.2 Carbon Reduction Program (CRP)

The CRP program is for projects that reduce transportation emissions and requires states to develop comprehensive carbon reduction strategies. Two categories of CRP exist federally, one for rural areas with a population of less than 5,000 and one for urban areas with a population in the range of 5,000 to 50,000. In Wisconsin, WisDOT administers these funds.

| Allowable Expenditures | Potential Yield | Timing | Assessment |
|---|---|---|---|
| Capital projects, retrofits, port electrification, public transportation project | Allocated to WI: $124.6M for 5 years (2022-2026)<br><br>CRP-Rural: $5.5.M annual allocation federally | Annual<br><br>SFY 2025-2028 | **OVERALL ASSESSMENT**<br>This grant could provide potential funding for any carbon reducing improvements with the ferry infrastructure.<br>***Opportunities***<br>• Includes diesel retrofits, electrification, and overall reduction of transportation emissions at port facilities<br>***Challenges***<br>• Seems more focused on bus/surface transportation connections. |

### 3.4.3 Recreational Trails Program (RTP)

Though allocated federally, this program is administered at the state level. In Wisconsin, it is administered by the Wisconsin Department of Natural Resources.

| Allowable Expenditures | Potential Yield | Timing | Assessment |
|---|---|---|---|
| Projects that develop and maintain recreational trails and trail-related facilities for both nonmotorized and motorized recreational trail uses | $250,000 | Application deadline is May 1st each year. | **OVERALL ASSESSMENT**<br>Potential application to Merrimac Ferry projects as part of the Ice Age Trail could be explored; however, the grant focuses on pedestrian and/or bicycle trail facilities.<br>***Opportunities***<br>• Funding can be used for rehabilitation and maintenance of existing trails<br>***Challenges***<br>• Uncertain of funding eligibility<br>• Reimbursement grant |