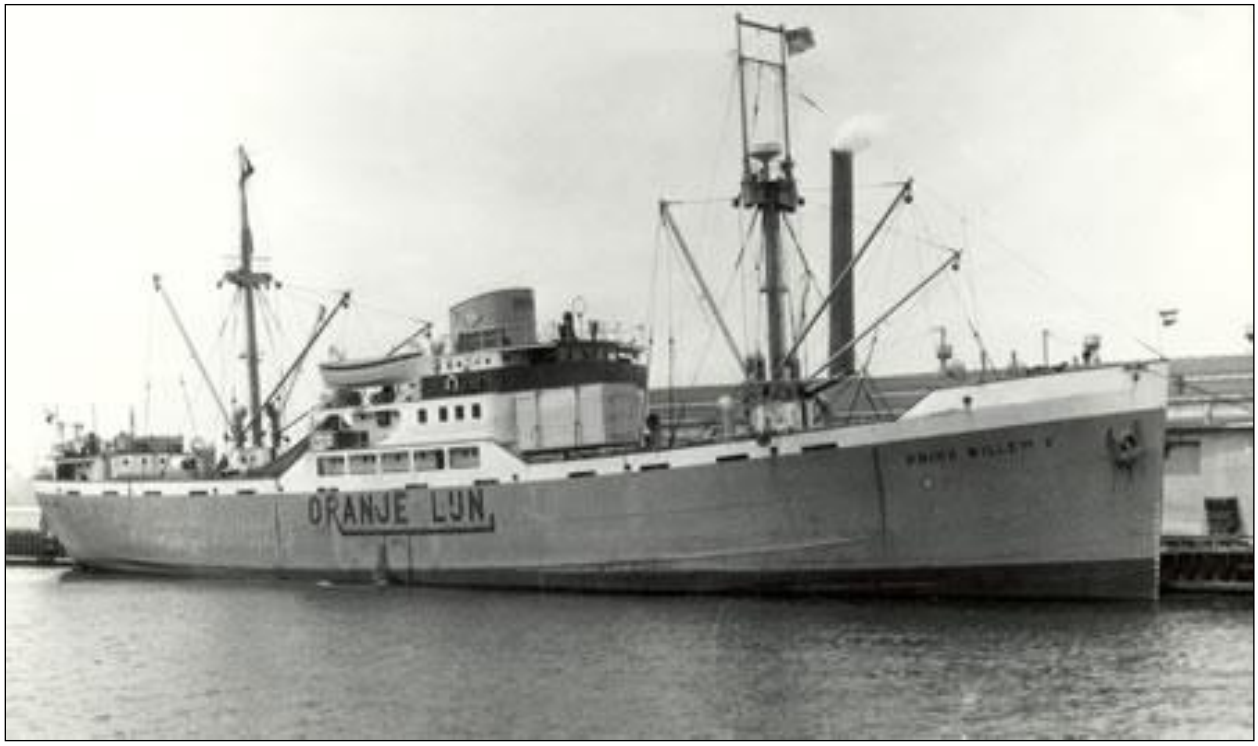
Office of National Marine Sanctuaries
Office of Response and Restoration

Screening Level Risk Assessment Package

Prins Willem V



RPI asa ENVIRONMENTAL RESEARCH CONSULTING

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National Oceanic and
Atmospheric Administration

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Photo: Photograph of *Prins Willem V*
Source: http://www.glwi.freshwater.uwm.edu/people/access_lab/onacruise/prinswillemv.php

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Project Background

The past century of commerce and warfare has left a legacy of thousands of sunken vessels along the U.S. coast. Many of these wrecks pose environmental threats because of the hazardous nature of their cargoes, presence of munitions, or bunker fuel oils left onboard. As these wrecks corrode and decay, they may release oil or hazardous materials. Although a few vessels, such as USS *Arizona* in Hawaii, are well-publicized environmental threats, most wrecks, unless they pose an immediate pollution threat or impede navigation, are left alone and are largely forgotten until they begin to leak.

In order to narrow down the potential sites for inclusion into regional and area contingency plans, in 2010, Congress appropriated $1 million to identify the most ecologically and economically significant potentially polluting wrecks in U.S. waters. This project supports the U.S. Coast Guard and the Regional Response Teams as well as NOAA in prioritizing threats to coastal resources while at the same time assessing the historical and cultural significance of these nonrenewable cultural resources.

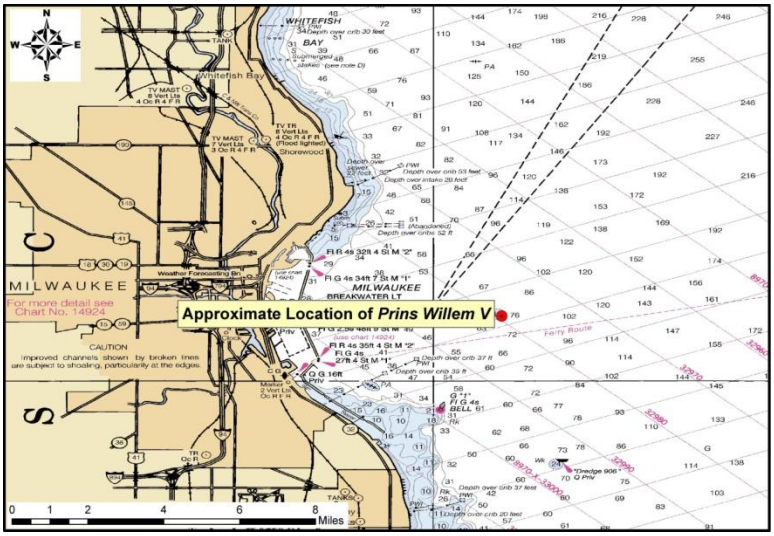
The potential polluting shipwrecks were identified through searching a broad variety of historical sources. NOAA then worked with Research Planning, Inc., RPS ASA, and Environmental Research Consulting to conduct the modeling forecasts, and the ecological and environmental resources at risk assessments.

Initial evaluations of shipwrecks located within American waters found that approximately 600-1,000 wrecks could pose a substantial pollution threat based on their age, type and size. This includes vessels sunk after 1891 (when vessels began being converted to use oil as fuel), vessels built of steel or other durable material (wooden vessels have likely deteriorated), cargo vessels over 1,000 gross tons (smaller vessels would have limited cargo or bunker capacity), and any tank vessel.

Additional ongoing research has revealed that 87 wrecks pose a potential pollution threat due to the violent nature in which some ships sank and the structural reduction and demolition of those that were navigational hazards. To further screen and prioritize these vessels, risk factors and scores have been applied to elements such as the amount of oil that could be on board and the potential ecological or environmental impact.

Executive Summary: *Prins Willem V*

The freighter *Prins Willem V*, sunk after a collision in Lake Michigan near Milwaukee, Wisconsin in 1954, was identified as a potential pollution threat, thus a screening-level risk assessment was conducted. The different sections of this document summarize what is known about the *Prins Willem V*, the results of environmental impact modeling composed of different release scenarios, the ecological and socio-economic resources that would be at risk in the event of releases, the screening-level risk scoring results and overall risk assessment, and recommendations for assessment, monitoring, or remediation.



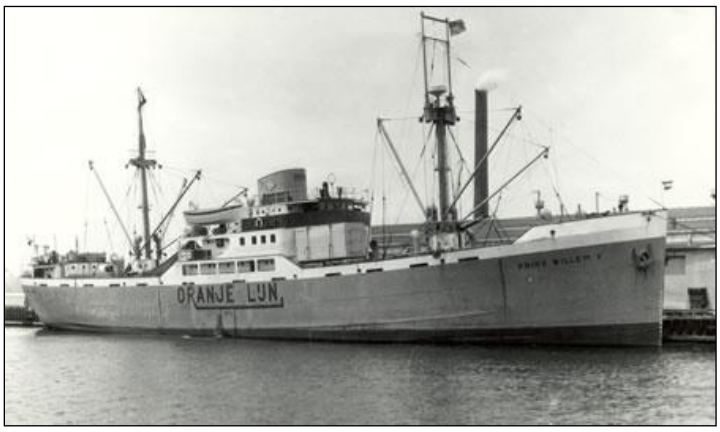
Based on this screening-level assessment, each vessel was assigned a summary score calculated using the seven risk criteria described in this report. For the Worst Case Discharge, *Prins Willem V* scores Medium with 14 points; for the Most Probable Discharge (10% of the Worse Case volume), *Prins Willem V* scores Low with 11 points. Given these scores, and the higher level of data certainty, NOAA recommends that this site be noted in Area Contingency Plans so that if a mystery spill is reported in the general area, this vessel could be investigated as a source. It should considered for an assessment if the resources at risk are underrepresented in this assessment. At a minimum, an active monitoring program should be implemented. Outreach efforts with the technical and recreational dive community as well as commercial and recreational fishermen who frequent the area would be helpful to gain awareness of localized spills in the site.

Vessel Risk Factors		Risk Score	
Pollution Potential Factors	A1: Oil Volume (total bbl)	Med	
	A2: Oil Type		
	B: Wreck Clearance		
	C1: Burning of the Ship		
	C2: Oil on Water		
	D1: Nature of Casualty		
	D2: Structural Breakup		
Archaeological Assessment	Archaeological Assessment	Not Scored	
Operational Factors	Wreck Orientation	Not Scored	
	Depth		
	Confirmation of Site Condition		
	Other Hazardous Materials		
	Munitions Onboard		
	Gravesite (Civilian/Military)		
	Historical Protection Eligibility		
		WCD	MP (10%)
Ecological Resources	3A: Water Column Resources	Med	Low
	3B: Water Surface Resources	Low	Low
	3C: Shore Resources	Low	Low
Socio-Economic Resources	4A: Water Column Resources	High	Med
	4B: Water Surface Resources	High	Med
	4C: Shore Resources	Med	Low
Summary Risk Scores		14	11

The determination of each risk factor is explained in the document. This summary table is found on page 38.

SECTION 1: VESSEL BACKGROUND INFORMATION: REMEDIATION OF UNDERWATER LEGACY ENVIRONMENTAL THREATS (RULET)

Vessel Particulars



Official Name: *Prins Willem V*

Official Number: 7318

Vessel Type: Freighter

Vessel Class: Unknown

Former Names: Unknown

Year Built: 1940

Builder: N.V. Scheepswerf en Machinefabreik, Rotterdam, Netherlands

Builder's Hull Number: Unknown

Flag: Netherlands

Owner at Loss: Mij Zeetransport, N. V., Anthony Ve Der & Co., West Plein 11, Rotterdam C. Netherlands

Controlled by: Unknown

Chartered to: Unknown

Operated by: Unknown

Homeport: Rotterdam, Holland

Length: 258 feet **Beam:** 40 feet **Depth:** Unknown

Gross Tonnage: 1,567 **Net Tonnage:** 812

Hull Material: Steel **Hull Fastenings:** Unknown **Powered by:** Oil engines

Bunker Type: Marine diesel **Bunker Capacity (bbl):** Unknown

Average Bunker Consumption (bbl) per 24 hours: Unknown

Liquid Cargo Capacity (bbl): Unknown **Dry Cargo Capacity:** Unknown

Tank or Hold Description: Two cargo holds with two hatches each

Casualty Information

Port Departed: Milwaukee, WI

Destination Port: Sarnia, Ontario

Date Departed: October 14, 1954

Date Lost: October 14, 1954

Number of Days Sailing: 1

Cause of Sinking: Collision

Latitude (DD): 43.02473

Longitude (DD): -87.80702

Nautical Miles to Shore: 5

Nautical Miles to NMS: N/A

Nautical Miles to MPA: 27.7

Nautical Miles to Fisheries: Unknown

Approximate Water Depth (Ft): 90

Bottom Type: Lake bottom (clay)

Is There a Wreck at This Location? The exact accuracy of the listed coordinates is not known, but the location of the wreck is well known and a popular recreational dive site

Wreck Orientation: Resting on its starboard side

Vessel Armament: None

Cargo Carried when Lost: 720 tons of general cargo

Cargo Oil Carried (bbl): 0

Cargo Oil Type: N/A

Probable Fuel Oil Remaining (bbl): Unknown

Fuel Type: Marine diesel

Total Oil Carried (bbl): Unknown

Dangerous Cargo or Munitions: No

Munitions Carried: None

Demolished after Sinking: No

Salvaged: Yes, partially

Cargo Lost: Yes, partially

Reportedly Leaking: No

Historically Significant: Yes

Gravesite: No

Salvage Owner: Not known if any

Wreck Location

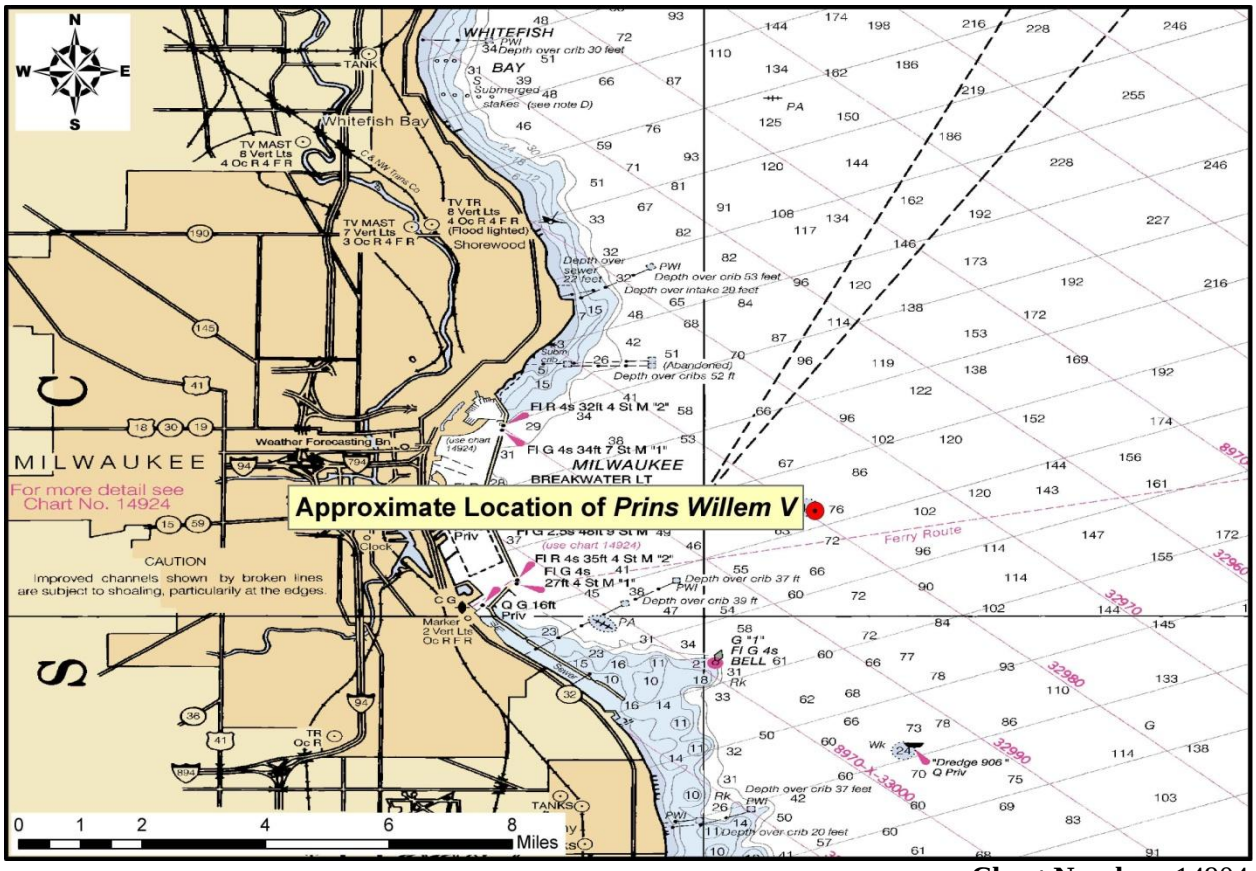


Chart Number: 14904

Casualty Narrative

"During the evening of 14 October 1954 the M/V PRINS WILLEM V (Netherlands), a general cargo vessel of 1567 g.t., was departing from Milwaukee en route to Sarnia, Onterio, and the motor tug SINCLAIR CHICAGO, of 292 g.t., towing astern on approximately 800 ft. of tow line the laden tank barge SINCLAIR NO. 12, of 846 g.t., was inbound to Milwaukee from Waukegan. The PRINS WILLEM V sighted the range lights and the port side light of the tug SINCLAIR CHICAGO off her starboard bow. Due to the off position of the lower tow light on the SINCLAIR CHICAGO, such light was not recognized as a towing vessel light. The master and mate on watch on the PRINS WILLEM V sighted no lights on the towed barge SINCLAIR NO. 12. Being the burdened vessel, the PRINS WILLEM V changed course to the right so as to pass astern of the SINCLAIR CHICAGO, but not knowing that the SINCLAIR CHICAGO had a laden tank barge in tow. The watch on the SINCLAIR CHICAGO observed the PRINS WILLEM V off to port on approximately a paralleling course and when the PRINS WILLEM V was observed changing course to the left to pass close across the stern of the SINCLAIR CHICAGO, the SINCLAIR CHICAGO played her search light on her towed barge astern and payed out the tow line to approximately 1500 ft., whereupon the PRINS WILLEM V changed course to the right, but unfortunately, due to close proximity, the PRINS WILLEM V and the towed barge SINCLAIR NO. 12, collided at 1916 approximately 1.7 miles east of the Milwaukee Breakwater entrance. Although no lives

were lost as a result of this casualty, the PRINS WILLEM V was holed and sunk and the SINCLAIR NO. 12 sustained bow damage."
-http://greatlakeshistory.homestead.com/files/PrinzWillem.pdf

General Notes

NOAA Automated Wreck and Obstruction Information System (AWOIS) Data:

HISTORY
CHARTING SOURCE UNKNOWN.

DESCRIPTION
M/V, STEEL, 250 FT L, 42 FT W, 2736 NT, SUNK 10/14/54 AT LAT 43-01-29, LONG 87-48-25; 40 FT CLEAR DEPTH PROVIDED BY DEMOLITION UNDER CONTRACT DATED 4/28/55, OTHER ATTEMPTS TO RAISE VESSEL UNSUCCESSFUL; CARGO OF HARDWARE AND MISC ITEMS BELIEVED TO BE INTACT.

SURVEY REQUIREMENTS FULL; NO RECORD OF BEING SURVEYED.

"From 1937 to 1972 the vessels of the Dutch flag "Oranje Line" were well known around the Great Lakes save for the World War Two years. Officially known as Maaschappij Zeetransport N.V., the firm was one of the first to provide regular liner service to Great Lakes ports.

Oranje had five ships dedicated to the inland trade when World War Two broke out in 1939. Only two of their vessels were still afloat when hostilities ceased in 1945. Their freighters had been ideal for trading through the old, pre-Seaway, St. Lawrence canals. Similar new tonnage was needed as the St. Lawrence Seaway was still only a dream and it would not be completed until 1959. One of the postwar additions to the Oranje Line remained inland due to an unfortunate accident.

The construction of the *Prins Willem V* began at Hardinxveld, Netherlands, in 1940 and the ship was intended for Great Lakes trading.

The vessel was not yet completed when the German occupation commenced so the hull was scuttled by the Dutch Navy at Rotterdam to impede the advancing forces.

Water and mud were pumped out of the hull in 1945 and it was refloated and completed. Service began in January 1949 and *Prins Willem V* stopped at Eastern Canadian ports when ice clogged passage to the Great Lakes. The ship is shown on the St. Lawrence in a photo by Daniel C. McCormick.

The 1,567 gross ton *Prins Willem V* made about five trips per year to freshwater ports but was lost in a collision on Lake Michigan, off Milwaukee, Wisconsin, on October 14, 1954. The tug *Sinclair Chicago* and barge *Sinclair XII* punched a 20-foot by 8-foot hole in the starboard side of the Dutch freighter, and *Prins Willem V* was doomed.

Efforts to rescue the thirty sailors on board were successful but attempts to save the ship were not. Plans to refloat the hull were soon under consideration but never developed. The ship was abandoned but not forgotten. An idea to refloat the hull in 1965 and use it to store and demonstrate firefighting equipment was considered but not pursued. Eventually an out of court settlement was reached and the owners were awarded $200,000.

Divers have found the underwater remains of the ship to be an attraction but apparently at least four have drowned in their attempts to visit *Prins Willem V*. In October 1997 one diver got tangled in a guy wire over the engine room and perished.

Oranje built a second *Prins Willem V* in 1956 and this vessel served the company well. It was sailing as *Araxos*, a sixth name, when damaged by a fire on May 21, 1979. Repair cost could not be justified, and this freighter was broken up for scrap at Durban, South Africa, in the fall of 1981."
-http://www.vos.noaa.gov/MWL/dec_05/prinswillemv.shtml

Wreck Condition/Salvage History

“This 258-foot-long Dutch freighter, nicknamed "the Willey," fell prey to a shipping accident on Oct. 13, 1954, about three or four miles from Milwaukee. It ran afoul of a towing cable, which cut open a 20- by 8-foot hole in the hull. Sinking into roughly 90 feet of water with a hold full of items ranging from television sets to twine and printing presses, the ship now rests in a soft, muddy bottom with a 45-degree list to starboard. The lake bottom is so soft that the wreck is still sinking into it. The deck is at roughly 40 feet, placing it in the range of basic Open Water (OW) divers, while the entire ship is in the range of Advanced Open Water (AOW) divers. These features, combined with the vessel's largely intact condition, have led Lake Michigan dive operators to label it one of the lake's most popular wrecks.”
-http://traveltips.usatoday.com/lake-michigan-wreck-diving-2561.html

Archaeological Assessment

The archaeological assessment provides additional primary source based documentation about the sinking of vessels. It also provides condition-based archaeological assessment of the wrecks when possible. It does not provide a risk-based score or definitively assess the pollution risk or lack thereof from these vessels, but includes additional information that could not be condensed into database form.

Where the current condition of a shipwreck is not known, data from other archaeological studies of similar types of shipwrecks provide the means for brief explanations of what the shipwreck might look like and specifically, whether it is thought there is sufficient structural integrity to retain oil. This is more subjective than the Pollution Potential Tree and computer-generated resource at risk models, and as such provides an additional viewpoint to examine risk assessments and assess the threat posed by these shipwrecks. It also addresses questions of historical significance and the relevant historic preservation laws and regulations that will govern on-site assessments.

In some cases where little additional historic information has been uncovered about the loss of a vessel, archaeological assessments cannot be made with any degree of certainty and were not prepared. For vessels with full archaeological assessments, NOAA archaeologists and contracted archivists have taken photographs of primary source documents from the National Archives that can be made available for future research or on-site activities.

Assessment

Since *Prins Willem V* sank in 1954, records relating to the loss of the vessel were not part of the National Archives record groups examined by NOAA archaeologists and the local U.S. Coast Guard District or Sector may have access to more records about this wreck than are available at the National Archives. This means that the best assessment on the sinking of the ship probably still comes from the U.S. Coast Guard’s Marine Board of Investigation Report written about this vessel and from additional reports readily accessible online.

Although it is not known if significant amounts of diesel oil remain inside this ship, the wreck is in very good condition and rests on its starboard side, which may have caused some of the oil to become trapped against the sides of the double bottom tanks that contained fuel. Alternatively, it is also possible that

much of this diesel oil escaped during the extensive salvage operations that took place on the wreck, but this has not been confirmed.

If the U.S. Coast Guard decides to assess this vessel, it should be noted that this vessel is of historic significance and will require appropriate actions be taken under the National Historic Preservation Act (NHPA) prior to any actions that could impact the integrity of the vessel. This vessel may be eligible for listing on the National Register of Historic Places and archaeologists with the State of Wisconsin should be consulted to ensure compliance with archaeological standards for assessing a historic resource.

Background Information References

Vessel Image Sources:
http://www.glwi.freshwater.uwm.edu/people/access_lab/onacruise/prinswillemv.php

Construction Diagrams or Plans in RULET Database? No

Text References:

-AWOIS database

-http://greatlakeshistory.homestead.com/files/PrinzWillem.pdf

-http://greatlakeshistory.homestead.com/files/p.htm

http://www.glwi.freshwater.uwm.edu/people/access_lab/onacruise/pdf/PrinsWillemVSalvage.pdf

Vessel Risk Factors

In this section, the risk factors that are associated with the vessel are defined and then applied to the *Prins Willem V* based on the information available. These factors are reflected in the pollution potential risk assessment development by the U.S. Coast Guard Salvage Engineering Response Team (SERT) as a means to apply a salvage engineer's perspective to the historical information gathered by NOAA. This analysis reflected in Figure 1-1 is simple and straightforward and, in combination with the accompanying archaeological assessment, provides a picture of the wreck that is as complete as possible based on current knowledge and best professional judgment. This assessment *does not* take into consideration operational constraints such as depth or unknown location, but rather attempts to provide a replicable and objective screening of the historical date for each vessel. SERT reviewed the general historical information available for the database as a whole and provided a stepwise analysis for an initial indication of Low/Medium/High values for each vessel.

In some instances, nuances from the archaeological assessment may provide additional input that will amend the score for Section 1. Where available, additional information that may have bearing on operational considerations for any assessment or remediation activities is provided.

Each risk factor is characterized as High, Medium, or Low Risk or a category-appropriate equivalent such as No, Unknown, Yes, or Yes Partially. The risk categories correlate to the decision points reflected in Figure 1-1.

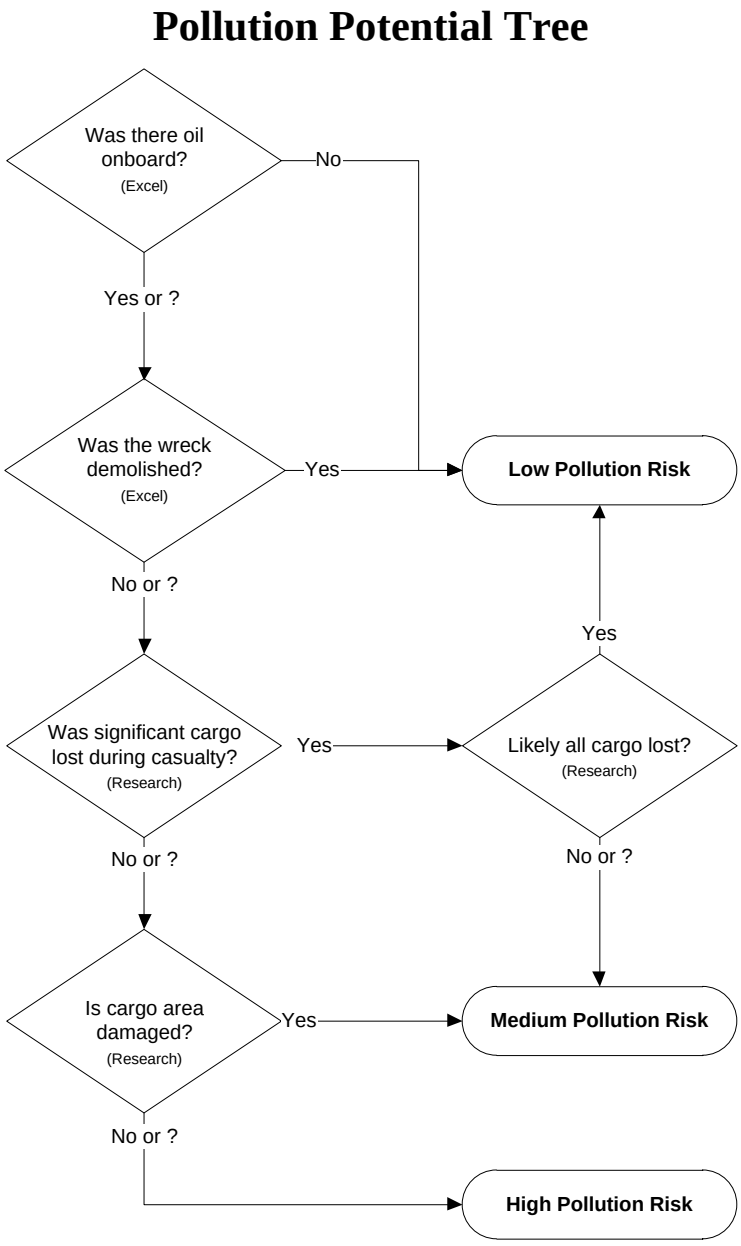


Figure 1-1: U.S. Coast Guard Salvage Engineering Response Team (SERT) developed the above Pollution Potential Decision Tree.

Each of the risk factors also has a "data quality modifier" that reflects the completeness and reliability of the information on which the risk ranks were assigned. The quality of the information is evaluated with respect to the factors required for a reasonable preliminary risk assessment. The data quality modifier scale is:

- **High Data Quality:** All or most pertinent information on wreck available to allow for thorough risk assessment and evaluation. The data quality is high and confirmed.
- **Medium Data Quality:** Much information on wreck available, but some key factor data are missing or the data quality is questionable or not verified. Some additional research needed.

- **Low Data Quality:** Significant issues exist with missing data on wreck that precludes making preliminary risk assessment, and/or the data quality is suspect. Significant additional research needed.

In the following sections, the definition of low, medium, and high for each risk factor is provided. Also, the classification for the *Prins Willem V* is provided, both as text and as shading of the applicable degree of risk bullet.

Pollution Potential Factors

Risk Factor A1: Total Oil Volume

The oil volume classifications correspond to the U.S. Coast Guard spill classifications:

- **Low Volume: Minor Spill** <240 bbl (10,000 gallons)
- **Medium Volume: Medium Spill** ≥240 – 2,400 bbl (100,000 gallons)
- **High Volume: Major Spill** ≥2,400 bbl (≥100,000 gallons)

The oil volume risk classifications refer to the volume of the most-likely Worst Case Discharge from the vessel and are based on the amount of oil believed or confirmed to be on the vessel.

The *Prins Willem V i*s ranked as High Volume because it is thought to have a potential for up to 3,000 bbl based on the gross tonnage of the vessel, although some of that may have been lost at the time of the casualty or after the vessel sank. Data quality is low because the actual bunker capacity of *Prins Willem V* is not known.

The risk factor for volume also incorporates any reports or anecdotal evidence of actual leakage from the vessel or reports from divers of oil in the overheads, as opposed to potential leakage. This reflects the history of the vessel's leakage. There are no reports of leakage from the *Prins Willem V*.

Risk Factor A2: Oil Type

The oil type(s) on board the wreck are classified only with regard to persistence, using the U.S. Coast Guard oil grouping[1]. (Toxicity is dealt with in the impact risk for the Resources at Risk classifications.) The three oil classifications are:

- **Low Risk: Group I Oils** – non-persistent oil (e.g., gasoline)
- **Medium Risk: Group II – III Oils** – medium persistent oil (e.g., diesel, No. 2 fuel, light crude, medium crude)
- **High Risk: Group IV** – high persistent oil (e.g., heavy crude oil, No. 6 fuel oil, Bunker C)

The *Prins Willem V* is classified as Medium Risk because the bunker fuel is diesel oil, a Group II oil type. Data quality is high.

[1] Group I Oil or Nonpersistent oil is defined as "a petroleum-based oil that, at the time of shipment, consists of hydrocarbon fractions: At least 50% of which, by volume, distill at a temperature of 340°C (645°F); and at least 95% of which, by volume, distill at a temperature of 370°C (700°F)."
Group II - Specific gravity less than 0.85 crude [API° >35.0]
Group III - Specific gravity between 0.85 and less than .95 [API° ≤35.0 and >17.5]
Group IV - Specific gravity between 0.95 to and including 1.0 [API° ≤17.5 and >10.0]

Was the wreck demolished?

Risk Factor B: Wreck Clearance

This risk factor addresses whether or not the vessel was historically reported to have been demolished as a hazard to navigation or by other means such as depth charges or aerial bombs. This risk factor is based on historic records and does not take into account what a wreck site currently looks like. The risk categories are defined as:

- **Low Risk:** The wreck was reported to have been entirely destroyed after the casualty
- **Medium Risk:** The wreck was reported to have been partially cleared or demolished after the casualty
- **High Risk:** The wreck was not reported to have been cleared or demolished after the casualty
- **Unknown:** It is not known whether or not the wreck was cleared or demolished at the time of or after the casualty

The *Prins Willem V* is classified as High Risk because there are no known historic accounts of the wreck being demolished as a hazard to navigation. Data quality is high.

Was significant cargo or bunker lost during casualty?

Risk Factor C1: Burning of the Ship

This risk factor addresses any burning that is known to have occurred at the time of the vessel casualty and may have resulted in oil products being consumed or breaks in the hull or tanks that would have increased the potential for oil to escape from the shipwreck. The risk categories are:

- **Low Risk:** Burned for multiple days
- **Medium Risk:** Burned for several hours
- **High Risk:** No burning reported at the time of the vessel casualty
- **Unknown:** It is not known whether or not the vessel burned at the time of the casualty

The *Prins Willem V* is classified as High Risk because there was no report of fire at the time of casualty. Data quality is high.

Risk Factor C2: Reported Oil on the Water

This risk factor addresses reports of oil on the water at the time of the vessel casualty. The amount is relative and based on the number of available reports of the casualty. Seldom are the reports from trained observers so this is very subjective information. The risk categories are defined as:

- **Low Risk:** Large amounts of oil reported on the water by multiple sources
- **Medium Risk:** Moderate to little oil reported on the water during or after the sinking event
- **High Risk:** No oil reported on the water
- **Unknown:** It is not known whether or not there was oil on the water at the time of the casualty

The *Prins Willem V* is classified as High Risk because there are no known reports of oil spreading across the water as the vessel went down. Data quality is high.

Is the cargo area damaged?

Risk Factor D1: Nature of the Casualty

This risk factor addresses the means by which the vessel sank. The risk associated with each type of casualty is determined by the how violent the sinking event was and the factors that would contribute to increased initial damage or destruction of the vessel (which would lower the risk of oil, other cargo, or munitions remaining on board). The risk categories are:

- **Low Risk:** Multiple torpedo detonations, multiple mines, severe explosion
- **Medium Risk:** Single torpedo, shellfire, single mine, rupture of hull, breaking in half, grounding on rocky shoreline
- **High Risk:** Foul weather, grounding on soft bottom, collision
- **Unknown:** The cause of the loss of the vessel is not known

The *Prins Willem V* is classified as High Risk because the vessel sank as the result of a collision. Data quality is high.

Risk Factor D2: Structural Breakup

This risk factor takes into account how many pieces the vessel broke into during the sinking event or since sinking. This factor addresses how likely it is that multiple components of a ship were broken apart including tanks, valves, and pipes. Experience has shown that even vessels broken in three large sections can still have significant pollutants on board if the sections still have some structural integrity. The risk categories are:

- **Low Risk:** The vessel is broken into more than three pieces
- **Medium Risk:** The vessel is broken into two-three pieces
- **High Risk:** The vessel is not broken and remains as one contiguous piece
- **Unknown:** It is currently not known whether or not the vessel broke apart at the time of loss or after sinking

The *Prins Willem V* is classified as High Risk because it is not broken apart and remains as one contiguous piece. Data quality is high.

Factors That May Impact Potential Operations

Orientation (degrees)

This factor addresses what may be known about the current orientation of the intact pieces of the wreck (with emphasis on those pieces where tanks are located) on the seafloor. For example, if the vessel turtled, not only may it have avoided demolition as a hazard to navigation, but it has a higher likelihood of retaining an oil cargo in the non-vented and more structurally robust bottom of the hull.

The *Prins Willem V* is resting on its starboard side unknown. Data quality is high.

Depth

Depth information is provided where known. In many instances, depth will be an approximation based on charted depths at the last known locations.

The *Prins Willem V* is 90 feet deep. Data quality is high.

Visual or Remote Sensing Confirmation of Site Condition

This factor takes into account what the physical status of wreck site as confirmed by remote sensing or other means such as ROV or diver observations and assesses its capability to retain a liquid cargo. This assesses whether or not the vessel was confirmed as entirely demolished as a hazard to navigation, or severely compromised by other means such as depth charges, aerial bombs, or structural collapse.

The location of the *Prins Willem V* is a popular dive site. Data quality is high.

Other Hazardous (Non-Oil) Cargo on Board

This factor addresses hazardous cargo other than oil that may be on board the vessel and could potentially be released, causing impacts to ecological and socio-economic resources at risk.

There are no reports of hazardous materials onboard. Data quality is high.

Munitions on Board

This factor addresses hazardous cargo other than oil that may be on board the vessel and could potentially be released or detonated causing impacts to ecological and socio-economic resources at risk.

The *Prins Willem V* did not carry any munitions. Data quality is high.

Vessel Pollution Potential Summary

Table 1-1 summarizes the risk factor scores for the pollution potential and mitigating factors that would reduce the pollution potential for the *Prins Willem V*. Operational factors are listed but do not have a risk score.

Table 1-1: Summary matrix for the vessel risk factors for the *Prins Willem V* color-coded as red (high risk), yellow (medium risk), and green (low risk).

Vessel Risk Factors		Data Quality Score	Comments	Risk Score
Pollution Potential Factors	A1: Oil Volume (total bbl)	Low	Maximum of 3,000 bbl, not reported to be leaking	**Med**
	A2: Oil Type	High	Bunker oil is diesel oil, a Group II oil type	
	B: Wreck Clearance	High	Vessel not reported as cleared	
	C1: Burning of the Ship	High	No fire was reported	
	C2: Oil on Water	High	No oil was reported on the water	
	D1: Nature of Casualty	High	Collision	
	D2: Structural Breakup	High	The vessel remains in one contiguous piece	
Archaeological Assessment	Archaeological Assessment	Low	The best sinking assessment still comes from the U.S. Coast Guard so a detailed archaeological assessment was not prepared	**Not Scored**
Operational Factors	Wreck Orientation	High	Resting on its starboard side	**Not Scored**
	Depth	High	90 ft	
	Visual or Remote Sensing Confirmation of Site Condition	High	The wreck is a popular dive site	
	Other Hazardous Materials Onboard	High	No	
	Munitions Onboard	High	No	
	Gravesite (Civilian/Military)	High	No	
	Historical Protection Eligibility (NHPA/SMCA)	High	NHPA	

SECTION 2: ENVIRONMENTAL IMPACT MODELING

To help evaluate the potential transport and fates of releases from sunken wrecks, NOAA worked with RPS ASA to run a series of generalized computer model simulations of potential oil releases. The results are used to assess potential impacts to ecological and socio-economic resources, as described in Sections 3 and 4. The modeling results are useful for this screening-level risk assessment; however, it should be noted that detailed site/vessel/and seasonally specific modeling would need to be conducted prior to any intervention on a specific wreck. In the Great Lakes, ice cover of varying extent may be present during the winter season. However, the presence and movement of lake ice was not included in the modeled scenarios. If ice cover is present at the time of a release, the oil would become trapped under the surface of the ice and remain there (unweathered) until the ice thaws. Upon thawing, the oil would be released, and would follow a trajectory similar to those estimated by our modeling.

Release Scenarios Used in the Modeling

The potential volume of leakage at any point in time will tend to follow a probability distribution. Most discharges are likely to be relatively small, though there could be multiple such discharges. There is a lower probability of larger discharges, though these scenarios would cause the greatest damage. A **Worst Case Discharge** (WCD) would involve the release of all of the cargo oil and bunkers present on the vessel. In the case of the *Prins Willem V* this would be about 3,000 bbl based on current estimates of the amount of oil remaining onboard the wreck.

The likeliest scenario of oil release from most sunken wrecks, including the *Prins Willem V*, is a small, episodic release that may be precipitated by disturbance of the vessel in storms. Each of these episodic releases may cause impacts and require a response. **Episodic** releases are modeled using 1% of the WCD. Another scenario is a very low chronic release, i.e., a relatively regular release of small amounts of oil that causes continuous oiling and impacts over the course of a long period of time. This type of release would likely be precipitated by corrosion of piping that allows oil to flow or bubble out at a slow, steady rate. **Chronic** releases are modeled using 0.1% of the WCD.

The **Most Probable** scenario is premised on the release of all the oil from one tank. In the absence of information on the number and condition of the cargo or fuel tanks for all the wrecks being assessed, this scenario is modeled using 10% of the WCD. The **Large** scenario is loss of 50% of the WCD. The five major types of releases are summarized in Table 2-1. The actual type of release that occurs will depend on the condition of the vessel, time factors, and disturbances to the wreck. Note that, the episodic and chronic release scenarios represent a small release that is repeated many times, potentially repeating the same magnitude and type of impact(s) with each release. The actual impacts would depend on the environmental factors such as real-time and forecast winds and currents during each release and the types/quantities of ecological and socio-economic resources present.

The model results here are based on running the ASA SIMAP (Spill Impact Map) Integrated Oil Spill Impact Model System two hundred times for each of the five spill volumes shown in Table 2-1. The model randomly selects the date of the release, and corresponding environmental, wind, and ocean current information from a long-term wind and current database.

When a spill occurs, the trajectory, fate, and effects of the oil will depend on environmental variables, such as the wind and current directions over the course of the oil release, as well as seasonal effects. The magnitude and nature of potential impacts to resources will also generally have a strong seasonal component (e.g., timing of bird migrations, turtle nesting periods, fishing seasons, and tourism seasons).

Table 2-1: Potential oil release scenario types for the *Prins Willem V*.

Scenario Type	Release per Episode	Time Period	Release Rate	Relative Likelihood	Response Tier
Chronic (0.1% of WCD)	3 bbl	Fairly regular intervals or constant	100 bbl over several days	More likely	Tier 1
Episodic (1% of WCD)	30 bbl	Irregular intervals	Over several hours or days	Most Probable	Tier 1-2
Most Probable (10% of WCD)	300 bbl	One-time release	Over several hours or days	Most Probable	Tier 2
Large (50% of WCD)	1,500 bbl	One-time release	Over several hours or days	Less likely	Tier 2-3
Worst Case	3,000 bbl	One-time release	Over several hours or days	Least likely	Tier 3

The modeling results represent 200 simulations for each spill volume with variations in spill trajectory based on winds and currents. The spectrum of the simulations gives a perspective on the variations in likely impact scenarios. Some resources will be impacted in nearly all cases; some resources may not be impacted unless the spill trajectory happens to go in that direction based on winds and currents at the time of the release and in its aftermath.

For the large and WCD scenarios, the duration of the release was assumed to be 12 hours, envisioning a storm scenario where the wreck is damaged or broken up, and the model simulations were run for a period of 30 days. The releases were assumed to be from a depth between 2-3 meters above the sea floor, using the information known about the wreck location and depth.

It is important to acknowledge that these scenarios are only for this screening-level assessment. Detailed site/vessel/and seasonally specific modeling would need to be conducted prior to any intervention on a specific wreck.

Oil Type for Release

The *Prins Willem V* contained marine diesel (a Group II oil). Thus, the oil spill model was run using light fuel oil.

Oil Thickness Thresholds

The model results are reported for different oil thickness thresholds, based on the amount of oil on the water surface or shoreline and the resources potentially at risk. Table 2-2 shows the terminology and thicknesses used in this report. A thickness of 0.01 g/m^2, which would appear as a barely visible sheen, was used as the threshold for socio-economic impacts to the water surface because often fishing is prohibited in areas with any visible oil, to prevent contamination of fishing gear and catch. A thickness of

1 g/m^2 was used as the threshold for socio-economic impacts to shorelines because that amount of oil would conservatively trigger the need for shoreline cleanup on amenity beaches. A thickness of 10 g/m^2 was used as the threshold for ecological impacts to the water surface, primarily due to impacts to birds, because that amount of oil has been observed to be enough to mortally impact birds and other wildlife. A thickness of 100 g/m^2 was used as the threshold for ecological impacts to shoreline habitats based a synthesis of the literature showing that shoreline life has been affected by this degree of oiling.[2]

Table 2-2: Oil thickness thresholds used in calculating area of water or miles of shoreline impacted. Refer to Sections 3 and 4 for explanations of the thresholds for ecological and socio-economic resource impacts.

Oil Description	Appearance	Approximate Thickness		Threshold/Risk Factor
Oil Sheen	Barely Visible	0.00001 mm	0.01 g/m2	Socio-economic Impacts to Water Surface/Risk Factor 4B-1 and 2
Oil Sheen	Dull Colors	0.001 mm	1 g/m2	Socio-economic Impacts to Shoreline Users/Risk Factor 4C-1 and 2
Heavy Oil Sheen	Dark Colors	0.01 mm	10 g/m2	Ecological Impacts to Water Surface/ Risk Factor 3B-1 and 2
Oil Slick	Brown to Black	0.1 mm	100 g/m2	Ecological Impacts to Shoreline Habitats/Risk Factor 3C-1 and 2

Potential Impacts to the Water Column

Impacts to the water column from an oil release from the *Prins Willem V* will be determined by the volume of leakage. Because oil from sunken vessels will be released at low pressures, the droplet sizes will be large enough for the oil to float to the surface. Therefore, impacts to water column resources will result from the natural dispersion of the floating oil slicks on the surface, which is limited to about the top 33 feet. The metric used for ranking impacts to the water column is the area of water surface in mi^2 that has been contaminated by 1 part per billion (ppb) oil to a depth of 33 feet. At 1 ppb, there are likely to be impacts to sensitive organisms in the water column and potential tainting of seafood, so this concentration is used as a screening threshold for both the ecological and socio-economic risk factors for water column resource impacts. To assist planners in understanding the scale of potential impacts for different leakage volumes, a regression curve was generated for the water column volume oiled using the five volume scenarios, which is shown in Figure 2-1. Using this figure, the water column impacts can be estimated for any spill volume.

[2] French, D., M. Reed, K. Jayko, S. Feng, H. Rines, S. Pavignano, T. Isaji, S. Puckett, A. Keller, F. W. French III, D. Gifford, J. McCue, G. Brown, E. MacDonald, J. Quirk, S. Natzke, R. Bishop, M. Welsh, M. Phillips and B.S. Ingram, 1996. The CERCLA type A natural resource damage assessment model for coastal and marine environments (NRDAM/CME), Technical Documentation, Vol. I - V. Office of Environmental Policy and Compliance, U.S. Dept. of the Interior, Washington, DC.

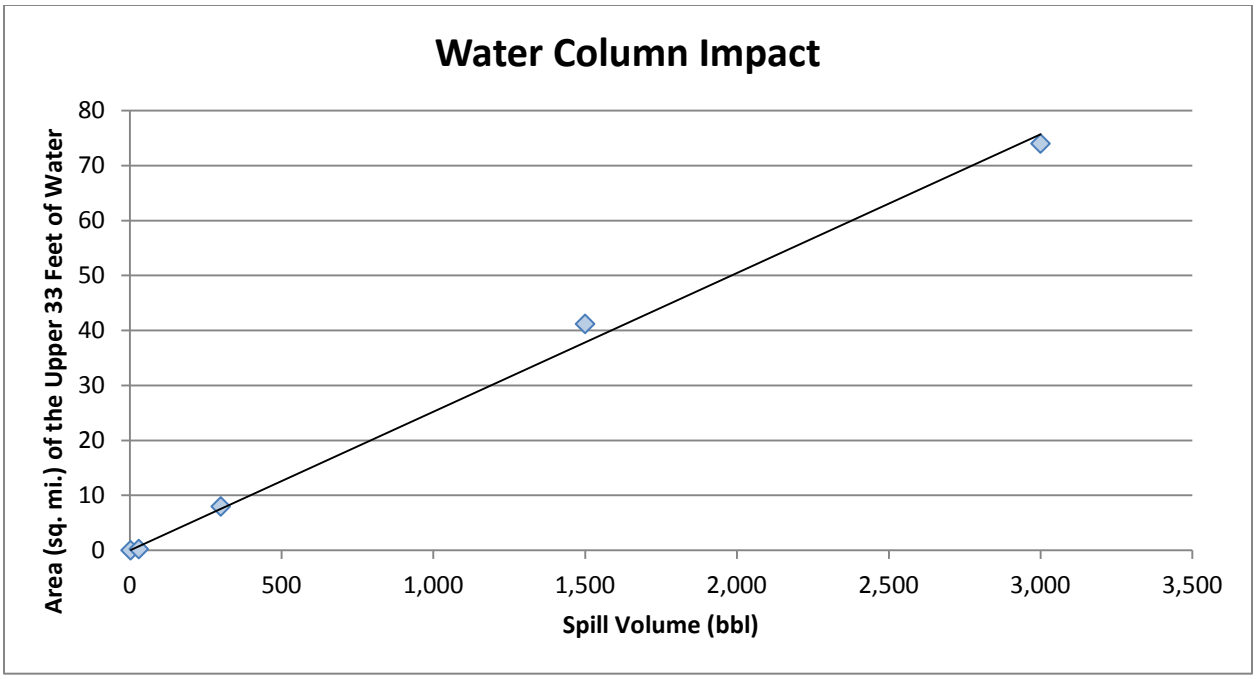


Figure 2-1: Regression curve for estimating the volume of water column at or above 1 ppb aromatics impacted as a function of spill volume for the *Prins Willem V*.

Potential Water Surface Slick

The slick size from an oil release from the *Prins Willem V* is a function of the quantity released. The estimated water surface coverage by a fresh slick (the total water surface area "swept" by oil over time) for the various scenarios is shown in Table 2-3, as the mean result of the 200 model runs. Note that this is an estimate of total water surface affected over a 30-day period. The slick will not be continuous but rather be broken and patchy due to the subsurface release of the oil. Surface expression is likely to be in the form of sheens, tarballs, and streamers.

Table 2-3: Estimated slick area swept on water for oil release scenarios from the *Prins Willem V*.

Scenario Type	Oil Volume (bbl)	Estimated Slick Area Swept Mean of All Models	
		0.01 g/m²	10 g/m²
Chronic	3	40 mi²	10 mi²
Episodic	30	220 mi²	41 mi²
Most Probable	300	700 mi²	180 mi²
Large	1,500	1,500 mi²	460 mi²
Worst Case Discharge	3,000	2,000 mi²	700 mi²

The location, size, shape, and spread of the oil slick(s) from an oil release from the *Prins Willem V* will depend on environmental conditions, including winds and currents, at the time of release and in its aftermath. The areas potentially affected by oil slicks, given that we cannot predict when the spill might occur and the range of possible wind and current conditions that might prevail after a release, are shown in Figure 2-2 and Figure 2-3 using the Most Probable volume and the socio-economic and ecological thresholds.

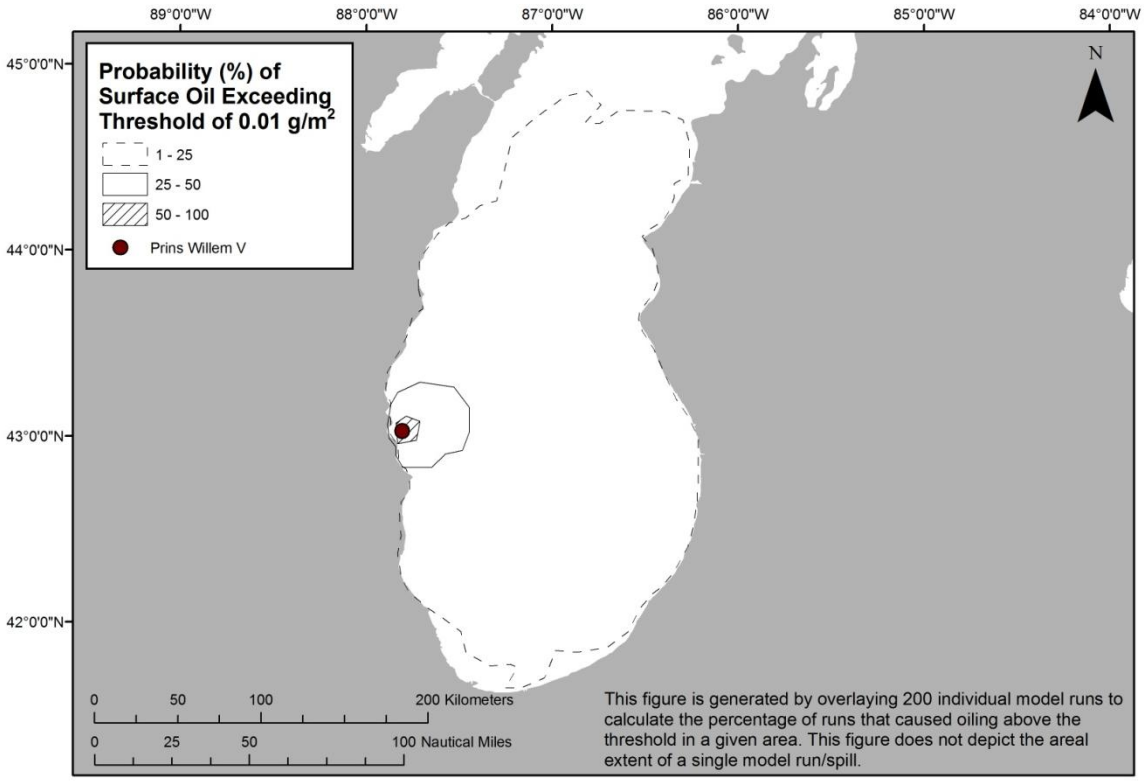


Figure 2-2: Probability of surface oil (exceeding 0.01 g/m^2) from the Most Probable spill of 300 bbl of light fuel oil from the *Prins Willem V* at the threshold for socio-economic resources at risk.

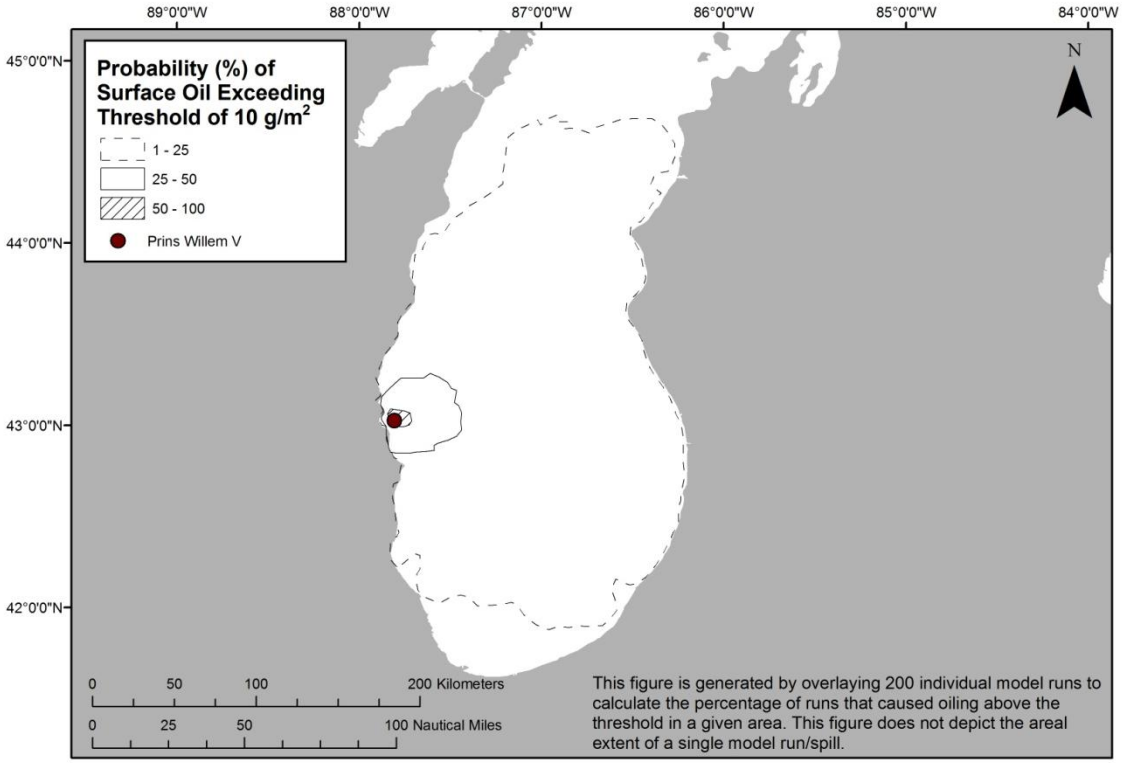


Figure 2-3: Probability of surface oil (exceeding 10 g/m^2) from the Most Probable spill of 300 bbl of light fuel oil from the *Prins Willem V* at the threshold for ecological resources at risk.

The maximum potential cumulative area swept by oil slicks at some time after a Most Probable Discharge is shown in Figure 2-4 as the timing of oil movements.

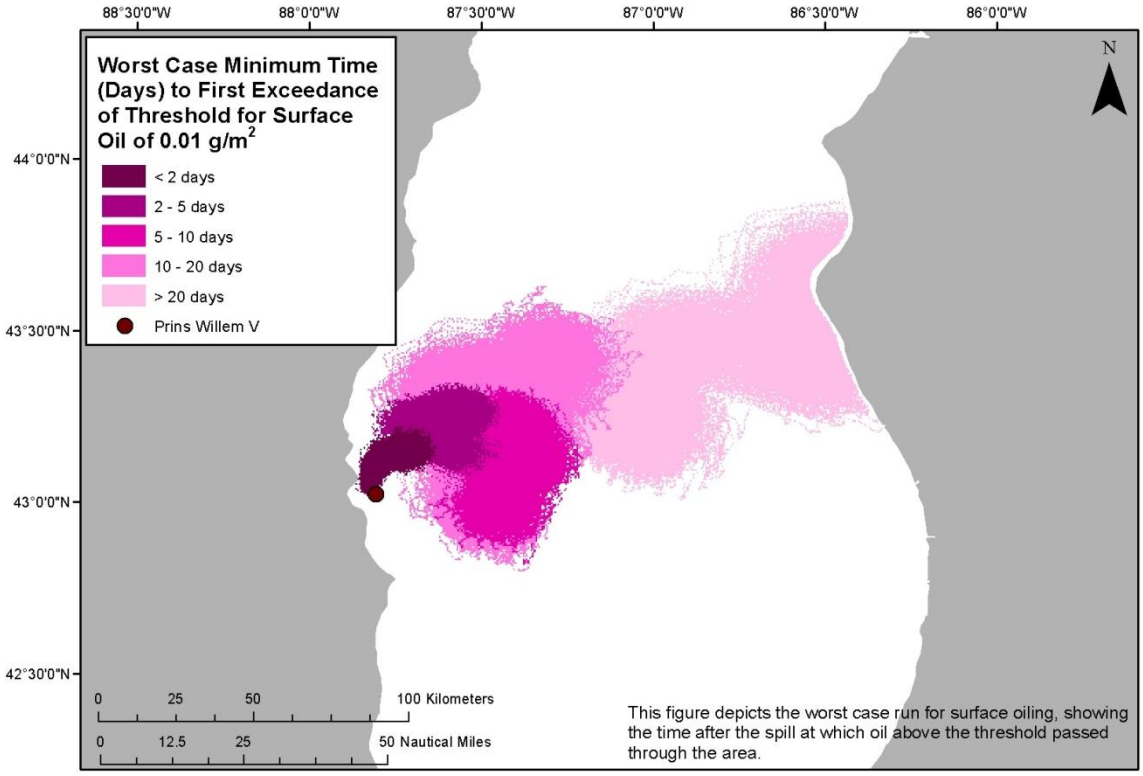


Figure 2-4: Water surface oiling from the Most Probable spill of 300 bbl of a light fuel oil from the *Prins Willem V* shown as the area over which the oil spreads at different time intervals.

The actual area affected by a release will be determined by the volume of leakage, whether it is from one or more tanks at a time. To assist planners in understanding the scale of potential impacts for different leakage volumes, a regression curve was generated for the water surface area oiled using the five volume scenarios, which is shown in Figure 2-5. Using this figure, the area of water surface with a barely visible sheen can be estimated for any spill volume.

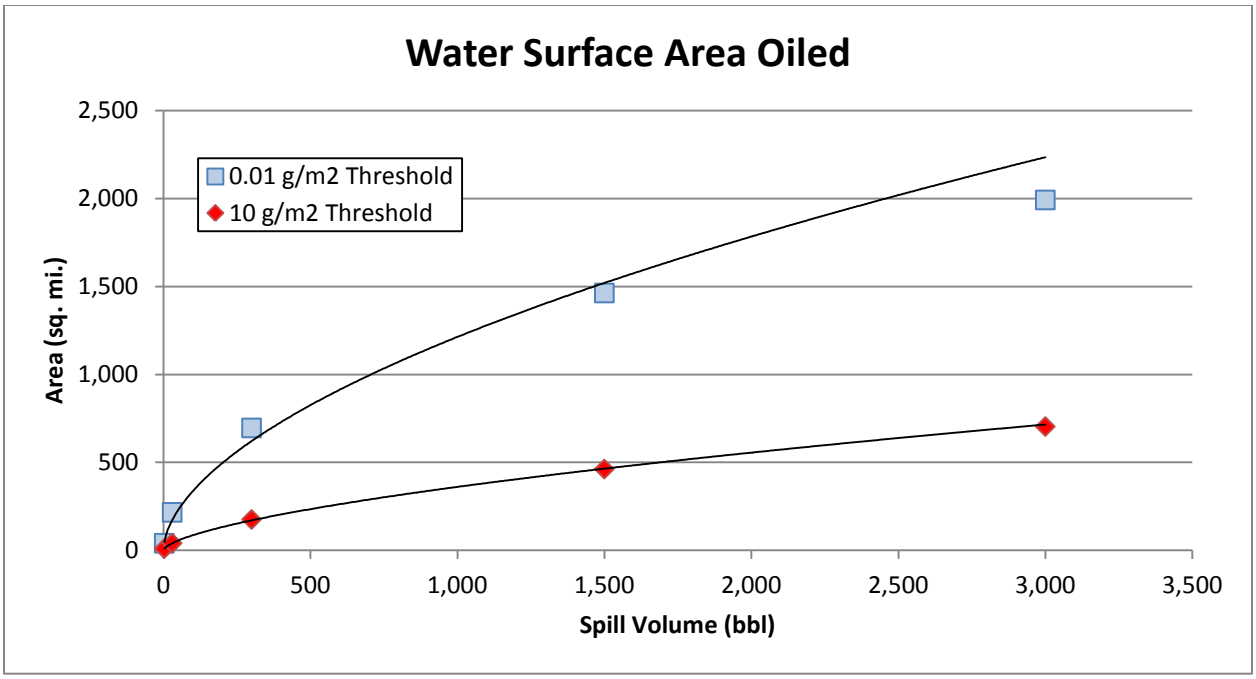


Figure 2-5: Regression curve for estimating the amount of water surface oiling as a function of spill volume for the *Prins Willem V*, showing both the ecological threshold of 10 g/m2 and socio-economic threshold of 0.01 g/m2.

Potential Shoreline Impacts

Based on these modeling results, shorelines on both sides of Lake Michigan are at risk. Figure 2-6 shows the probability of oil stranding on the shoreline at concentrations that exceed the threshold of 1 g/m^2, for the Most Probable release of 300 bbl. However, the specific areas that would be oiled will depend on the currents and winds at the time of the oil release(s), as well as on the amount of oil released. Figure 2-7 shows the single oil spill scenario that resulted in the maximum extent of shoreline oiling for the Most Probable volume. Estimated miles of shoreline oiling above the threshold of 1 g/m^2 by scenario type are shown in Table 2-4.

Table 2-4: Estimated shoreline oiling from leakage from the *Prins Willem V*.

Scenario Type	Volume (bbl)	Estimated Miles of Shoreline Oiling Above 1 g/m^2			
		Rock/Gravel/Artificial	Sand	Wetland/Mudflat	Total
Chronic	3	0	0	0	0.0
Episodic	30	0	0	0	0.5
Most Probable	300	2	1	0	2.9
Large	1,500	4	3	0	7.1
Worst Case Discharge	3,000	5	4	0	9.2

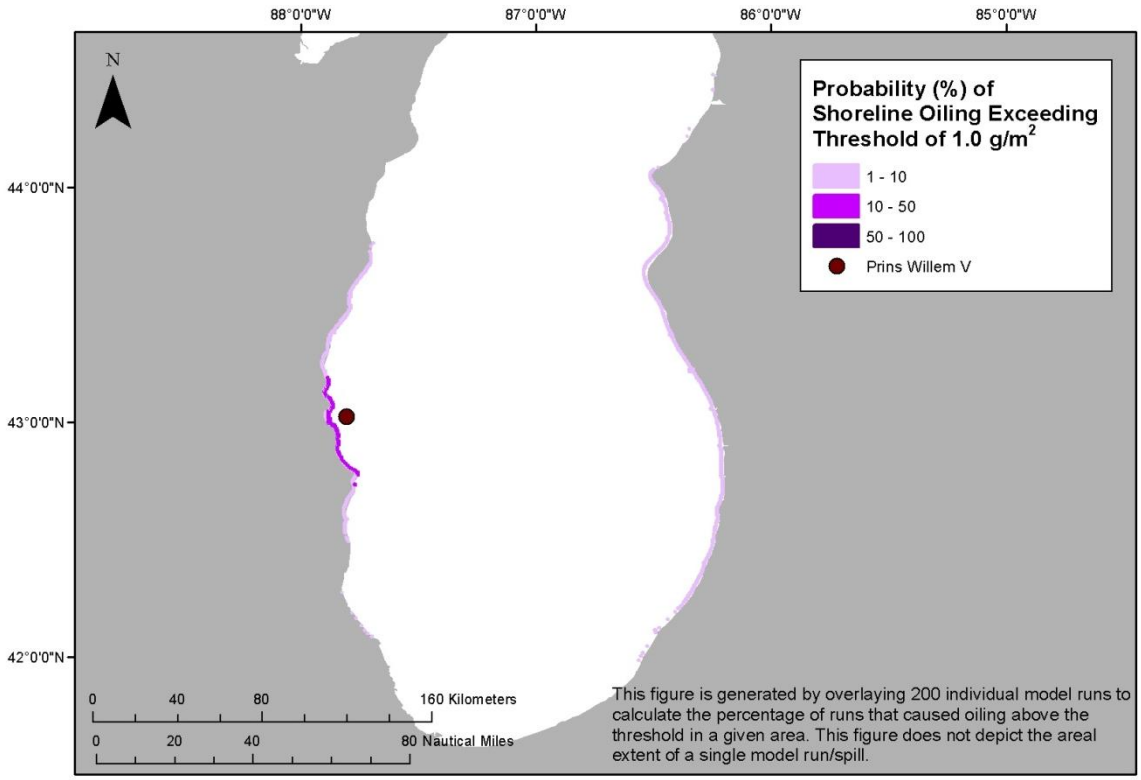


Figure 2-6: Probability of shoreline oiling (exceeding 1.0 g/m2) from the Most Probable Discharge of 300 bbl of light fuel oil from the *Prins Willem V*.

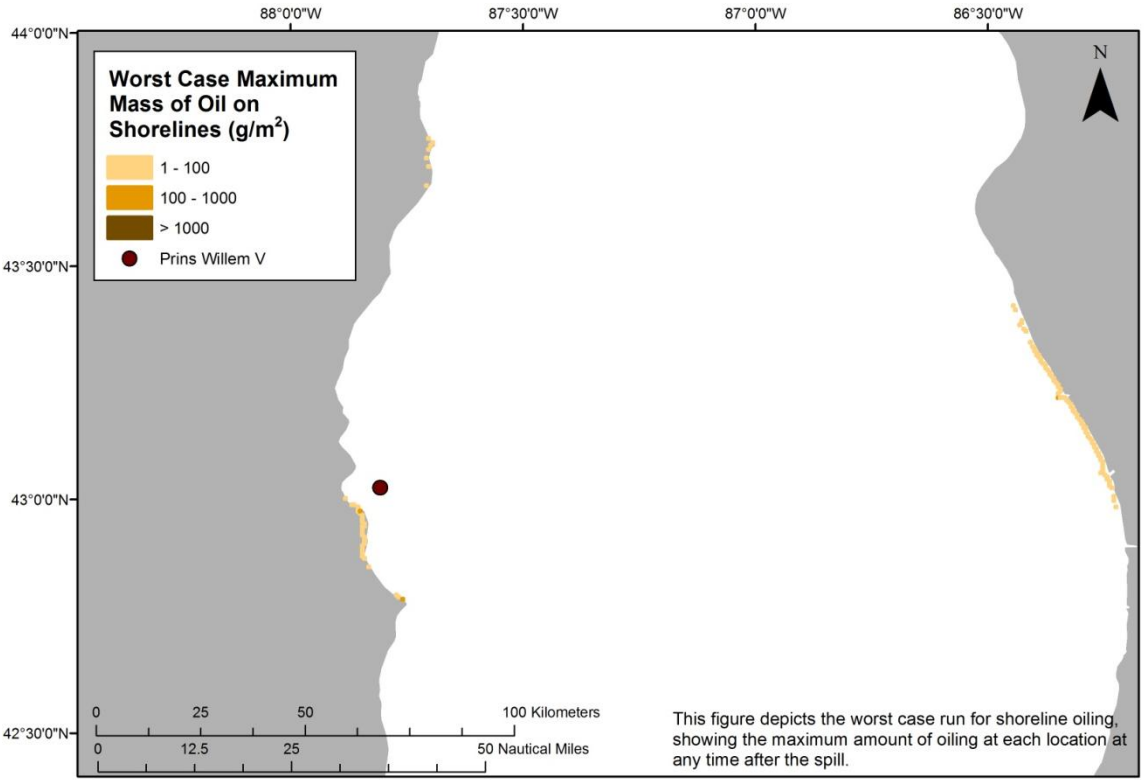


Figure 2-7: The extent and degree of shoreline oiling from the single model run of the Most Probable Discharge of 300 bbl of light fuel oil from the *Prins Willem V* that resulted in the greatest shoreline oiling.

The actual shore length affected by a release will be determined by the volume of leakage and environmental conditions during an actual release. To assist planners in scaling the potential impact for different leakage volumes, a regression curve was generated for the total shoreline length oiled using the five volume scenarios, which is shown in Figure 2-8. Using this figure, the shore length oiled can be estimated for any spill volume.

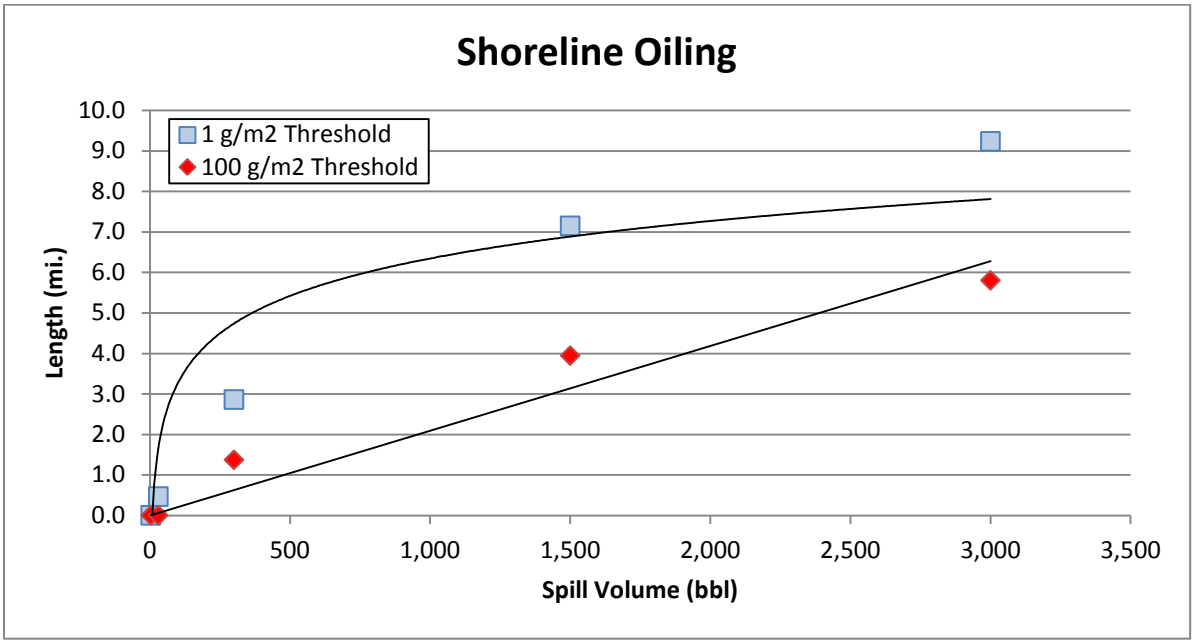


Figure 2-8: Regression curve for estimating the amount of shoreline oiling at different thresholds as a function of spill volume for the *Prins Willem V*.

The worst case scenario for shoreline exposure along the potentially impacted area for the WCD volume (Table 2-5) and the Most Probable volume (Table 2-6) consists primarily of sand beaches and artificial shorelines.

Table 2-5: Worst case scenario shoreline impact by habitat type and oil thickness for a leakage of 3,000 bbl from the *Prins Willem V*.

Shoreline/Habitat Type	Lighter Oiling Oil Thickness <1 mm Oil Thickness >1 g/m²	Heavier Oiling Oil Thickness >1 mm Oil Thickness >100 g/m²
Rocky and artificial shores/Gravel beaches	15 miles	9 miles
Sand beaches	24 miles	15 miles
Salt marshes and tidal flats	0 miles	0 miles

Table 2-6: Worst case scenario shoreline impact by habitat type and oil thickness for a leakage of 300 bbl from the *Prins Willem V*.

Shoreline/Habitat Type	Lighter Oiling Oil Thickness <1 mm Oil Thickness >1 g/m²	Heavier Oiling Oil Thickness >1 mm Oil Thickness >100 g/m²
Rocky and artificial shores/Gravel beaches	4 miles	0.3 miles
Sand beaches	18 miles	0 miles
Salt marshes and tidal flats	0 miles	0 miles

SECTION 3: ECOLOGICAL RESOURCES AT RISK

Ecological resources at risk from a catastrophic release of oil from the *Prins Willem V* (Table 3-1) include numerous guilds of birds, particularly those sensitive to surface oiling while rafting or plunge diving to feed and are present in nearshore/offshore waters. As can be noted in the table, large number of birds winter in both coastal and offshore waters, and many of the beaches are very important shorebird habitat. In addition, this region is important for commercially important fish and invertebrates.

Table 3-1. Ecological resources at risk from a release of oil from the *Prins Willem V*.
(FT = Federal threatened; FE = Federal endangered; ST = State threatened, SE = State endangered).

Species Group	Species Subgroup and Geography	Seasonal Presence
Diving Ducks, Waterfowl and Seabirds	Nearshore areas are important foraging locations for migratory and overwintering ring-billed and herring gulls, Caspian (SE), common (SE) and Forster's (SE) terns, diving ducks (scaup, scoters, mergansers), common loon, horned and pied-billed grebes, and Canada geese • Important locations: Sheboygan Reef, Ozaukee Bight, Harrington Beach Lakeshore • Greater scaup, common goldeneye, bufflehead, red-breasted merganser are highly abundant; long tailed duck, white-winged scoter, black scoter, surf scoter are common • Rare gull species have been seen here on occasion (wintering glaucous, Iceland, Thayer's, lesser black-backed, greater black-backed, ivory gulls)	Shorebirds present Apr-Oct Waterfowl/diving ducks present Aug-May
Shorebirds	Critical migratory and foraging habitat for piping plover (FE) exists along shorelines in the area of impact and plovers historically nested in the region Populations of other shorebirds can be found along the lakeshore in highest numbers in spring and fall, including sanderling, dunlin, common snipe, and spotted, least, semipalmated, pectoral sandpipers	Piping plover present spring/fall Shorebirds present spring-fall
Raptors and Passerines	Migratory raptors (bald eagle, osprey, peregrine falcon (SE), red-shouldered hawk (ST), northern goshawk) and passerines use these areas • 1000s of migrating raptors use Ozaukee Bight in fall; lower numbers in spring	Raptors present Aug -May
Mammals	Raccoon, mink, river otter and beaver occur in nearshore habitats	Year round
Fish	Lake Michigan is home to almost 100 species of fish; the lakeshore and adjacent rivers support important recreational fisheries Coastal rivers support higher diversity of species, such as shiners, catfish, sunfish, perches, including longear sunfish (ST) and greater redhorse (ST) Coastal wetlands comprise very little of shoreline but are extremely important juvenile and forage fish habitat Many fish spawn seasonally in nearshore or upstream areas • Mouths of rivers are spawning/aggregation hotspots for rainbow trout, yellow perch, rainbow smelt, muskellunge, walleye, gizzard shad, rock bass, northern pike, carp, spottail shiner, smallmouth bass, alewife, coho salmon, lake whitefish, brook trout, lake trout, Chinook salmon, brown trout • Lake whitefish are abundant near shorelines in the fall and spawn in shallow rock or sand bottomed lake waters less than 25 feet deep • Lake trout spawn on nearshore shoals throughout the area of impact • Brook trout spawn over hard substrate along the lakeshore • Rainbow trout spawn in the mouths of rivers	*Spring spawning* Lake sturgeon, walleye, rainbow trout, yellow perch, rainbow smelt, muskellunge, gizzard shad, rock bass *Summer spawning* Spottail shiner, smallmouth bass, carp, alewife *Fall spawning* Lake whitefish, lake trout, coho and Chinook salmon, brown trout, lake trout

The Environmental Sensitivity Index (ESI) atlases for the potentially impacted coastal areas from a leak from the *Prins Willem V* are generally available at each U.S. Coast Guard Sector. They can also be downloaded at: http://response.restoration.noaa.gov/esi. These maps show detailed spatial information on the distribution of sensitive shoreline habitats, biological resources, and human-use resources. The tables on the back of the maps provide more detailed life-history information for each species and location. The ESI atlases should be consulted to assess the potential environmental resources at risk for specific spill scenarios. In addition, the Geographic Response Plans within the Area Contingency Plans prepared by the Area Committee for each U.S. Coast Guard Sector have detailed information on the nearshore and shoreline ecological resources at risk and should be consulted.

Ecological Risk Factors

Risk Factor 3: Impacts to Ecological Resources at Risk (EcoRAR)

Ecological resources include plants and animals (e.g., fish, birds, invertebrates, and mammals), as well as the habitats in which they live. All impact factors are based on both the Worst Case and the Most Probable Discharge oil release from the wreck. Risk factors for ecological resources at risk (EcoRAR) are divided into three categories:

- Impacts to the water column and resources in the water column;
- Impacts to the water surface and resources on the water surface; and
- Impacts to the shoreline and resources on the shoreline.

The impacts from an oil release from the wreck would depend greatly on the direction in which the oil slick moves, which would, in turn, depend on wind direction and currents at the time of and after the oil release. Impacts are characterized in the risk analysis based on the likelihood of any measurable impact, as well as the degree of impact that would be expected if there is an impact. The measure of the degree of impact is based on the median case for which there is at least some impact. The median case is the "middle case" – half of the cases with significant impacts have less impact than this case, and half have more.

For each of the three ecological resources at risk categories, risk is defined as:

- The **probability of oiling** over a certain threshold (i.e., the likelihood that there will be an impact to ecological resources over a certain minimal amount); and
- The **degree of oiling** (the magnitude or amount of that impact).

As a reminder, the ecological impact thresholds are: 1 ppb aromatics for water column impacts; 10 g/m^2 for water surface impacts; and 100 g/m^2 for shoreline impacts.

In the following sections, the definition of low, medium, and high for each ecological risk factor is provided. Also, the classification for the *Prins Willem V* is provided, both as text and as shading of the applicable degree of risk bullet, for the WCD release of 3,000 bbl and a border around the Most Probable Discharge of 300 bbl.

Risk Factor 3A: Water Column Impacts to EcoRAR

Water column impacts occur beneath the water surface. The ecological resources at risk for water column impacts are fish, marine mammals, and invertebrates (e.g., shellfish, and small organisms that are food for larger organisms in the food chain). These organisms can be affected by toxic components in the oil. The threshold for water column impact to ecological resources at risk is a dissolved aromatic hydrocarbons concentration of 1 ppb (i.e., 1 part total dissolved aromatics per one billion parts water). Dissolved aromatic hydrocarbons are the most toxic part of the oil. At this concentration and above, one would expect impacts to organisms in the water column.

Risk Factor 3A-1: Water Column Probability of Oiling of EcoRAR

This risk factor reflects the probability that at least 0.2 mi^2 of the upper 33 feet of the water column would be contaminated with a high enough concentration of oil to cause ecological impacts. The three risk scores for water column oiling probability are:

- **Low Oiling Probability:** Probability = <10%
- **Medium Oiling Probability:** Probability = 10 – 50%
- **High Oiling Probability:** Probability > 50%

Risk Factor 3A-2: Water Column Degree of Oiling of EcoRAR

The degree of oiling of the water column reflects the total volume of water that would be contaminated by oil at a concentration high enough to cause impacts. The three categories of impact are:

- **Low Impact:** impact on less than 0.2 mi^2 of the upper 33 feet of the water column at the threshold level
- **Medium Impact**: impact on 0.2 to 200 mi^2 of the upper 33 feet of the water column at the threshold level
- **High Impact:** impact on more than 200 mi^2 of the upper 33 feet of the water column at the threshold level

The *Prins Willem V* is classified as High Risk for oiling probability for water column ecological resources for the WCD of 3,000 bbl because 99% of the model runs resulted in contamination of more than 0.2 mi^2 of the upper 33 feet of the water column above the threshold of 1 ppb aromatics. It is classified as Medium Risk for degree of oiling because the mean volume of water contaminated was 74 mi^2 of the upper 33 feet of the water column. For the Most Probable Discharge of 300 bbl, the *Prins Willem V* is classified as High Risk for oiling probability for water column ecological resources because 89% of the model runs resulted in contamination of more than 0.2 mi^2 of the upper 33 feet of the water column above the threshold of 1 ppb aromatics. It is classified as Medium Risk for degree of oiling because the mean volume of water contaminated was 8 mi^2 of the upper 33 feet of the water column.

Risk Factor 3B: Water Surface Impacts to EcoRAR

Ecological resources at risk at the water surface include surface feeding and diving sea birds, sea turtles, and marine mammals. These organisms can be affected by the toxicity of the oil as well as from coating with oil. The threshold for water surface oiling impact to ecological resources at risk is 10 g/m^2 (10 grams of floating oil per square meter of water surface). At this concentration and above, one would expect impacts to birds and other animals that spend time on the water surface.

Risk Factor 3B-1: Water Surface Probability of Oiling of EcoRAR

This risk factor reflects the probability that at least 1,000 mi^2 of the water surface would be affected by enough oil to cause impacts to ecological resources. The three risk scores for oiling are:

- **Low Oiling Probability:** Probability = <10%
- **Medium Oiling Probability:** Probability = 10 – 50%
- **High Oiling Probability:** Probability > 50%

Risk Factor 3B-2: Water Surface Degree of Oiling of EcoRAR

The degree of oiling of the water surface reflects the total amount of oil that would affect the water surface in the event of a discharge from the vessel. The three categories of impact are:

- **Low Impact:** less than 1,000 mi^2 of water surface impact at the threshold level
- **Medium Impact:** 1,000 to 10,000 mi^2 of water surface impact at the threshold level
- **High Impact:** more than 10,000 mi^2 of water surface impact at the threshold level

The *Prins Willem V* is classified as Medium Risk for oiling probability for water surface ecological resources for the WCD because 23% of the model runs resulted in at least 1,000 mi^2 of the water surface affected above the threshold of 10 g/m^2. It is Low Risk for degree of oiling because the mean area of water contaminated was 704 mi^2. The *Prins Willem V* is classified as Low Risk for oiling probability for water surface ecological resources for the Most Probable Discharge because 1% of the model runs resulted in at least 1,000 mi^2 of the water surface affected above the threshold of 10 g/m^2. It is classified as Low Risk for degree of oiling because the mean area of water contaminated was 175 mi^2.

Risk Factor 3C: Shoreline Impacts to EcoRAR

The impacts to different types of shorelines vary based on their type and the organisms that live on them. In this risk analysis, shorelines have been weighted by their degree of sensitivity to oiling. Wetlands are the most sensitive (weighted as "3" in the impact modeling), rocky and gravel shores are moderately sensitive (weighted as "2"), and sand beaches (weighted as "1") are the least sensitive to ecological impacts of oil.

Risk Factor 3C-1: Shoreline Probability of Oiling of EcoRAR

This risk factor reflects the probability that the shoreline would be coated by enough oil to cause impacts to shoreline organisms. The threshold for shoreline oiling impacts to ecological resources at risk is 100 g/m^2 (i.e., 100 grams of oil per square meter of shoreline). The three risk scores for oiling are:

- **Low Oiling Probability:** Probability = <10%
- **Medium Oiling Probability:** Probability = 10 – 50%
- **High Oiling Probability:** Probability > 50%

Risk Factor 3C-2: Shoreline Degree of Oiling of EcoRAR

The degree of oiling of the shoreline reflects the length of shorelines oiled by at least 100 g/m^2 in the event of a discharge from the vessel. The three categories of impact are:

- **Low Impact:** less than 10 miles of shoreline impacted at the threshold level
- **Medium Impact:** 10 - 100 miles of shoreline impacted at the threshold level
- **High Impact:** more than 100 miles of shoreline impacted at the threshold level

The *Prins Willem V* is classified as High Risk for oiling probability for shoreline ecological resources for the WCD because 89% of the model runs resulted in shorelines affected above the threshold of 100 g/m^2. It is classified as Low Risk for degree of oiling because the mean weighted length of shoreline contaminated was 9 miles. The *Prins Willem V* is classified as High Risk to shoreline ecological resources for the Most Probable Discharge because 65% of the model runs resulted in shorelines affected above the threshold of 100 g/m^2. It is classified as Low Risk for degree of oiling because the mean weighted length of shoreline contaminated was 3 miles.

Considering the modeled risk scores and the ecological resources at risk, the ecological risk from potential releases of the WCD of 3,000 bbl of light fuel oil from the *Prins Willem V* is summarized as listed below and indicated in the far-right column in Table 3-2:

- Water column resources – Medium, because nearshore fish spawning areas could be affected
- Water surface resources – Low, because of the relatively small amount of surface water affected and the lack of high concentrations of birds in these areas. It should be noted that oil on the surface will not be continuous but rather be broken and patchy and in the form of sheens and streamers
- Shoreline resources – Low, because of the limited amount of shoreline impacts by a light, non-persistent oil on mostly man-made structures and sand beaches

Table 3-2: Ecological risk factor scores for the **Worst Case Discharge of 3,000 bbl** of light fuel oil from the *Prins Willem V*.

Risk Factor	Risk Score			Explanation of Risk Score	Final Score
3A-1: Water Column Probability EcoRAR Oiling	Low	Medium	High	99% of the model runs resulted in at least 0.2 mi^2 of the upper 33 feet of the water column contaminated above 1 ppb aromatics	Med
3A-2: Water Column Degree EcoRAR Oiling	Low	**Medium**	High	The mean volume of water contaminated above 1 ppb was 74 mi^2 of the upper 33 feet of the water column	
3B-1: Water Surface Probability EcoRAR Oiling	Low	**Medium**	High	23% of the model runs resulted in at least 1,000 mi^2 of water surface covered by at least 10 g/m^2	Low
3B-2: Water Surface Degree EcoRAR Oiling	**Low**	Medium	High	The mean area of water contaminated above 10 g/m^2 was 704 mi^2	
3C-1: Shoreline Probability EcoRAR Oiling	Low	Medium	High	89% of the model runs resulted in shoreline oiling of 100 g/m^2	Low
3C-2: Shoreline Degree EcoRAR Oiling	**Low**	Medium	High	The length of shoreline contaminated by at least 100 g/m^2 was 9 mi	

Considering the modeled risk scores and the ecological resources at risk, the ecological risk from potential releases of the WCD of 300 bbl of light fuel oil from the *Prins Willem V* is summarized as listed below and indicated in the far-right column in Table 3-3:

- Water column resources – Low, because the small area potentially affected
- Water surface resources – Low, because of the relatively small amount of surface water affected and the lack of high concentrations of birds in these areas. It should be noted that oil on the surface will not be continuous but rather be broken and patchy and in the form of sheens and streamers
- Shoreline resources – Low, because of the very small amount of shoreline impacts by a light, non-persistent oil on mostly man-made structures and sand beaches

Table 3-3: Ecological risk factor scores for the **Most Probable Discharge of 300 bbl** of light fuel oil from the *Prins Willem V*.

Risk Factor	Risk Score			Explanation of Risk Score	Final Score
3A-1: Water Column Probability EcoRAR Oiling	Low	Medium	High	89% of the model runs resulted in at least 0.2 mi^2 of the upper 33 feet of the water column contaminated above 1 ppb aromatics	Low
3A-2: Water Column Degree EcoRAR Oiling	Low	Medium	High	The mean volume of water contaminated above 1 ppb was 8 mi^2 of the upper 33 feet of the water column	
3B-1: Water Surface Probability EcoRAR Oiling	Low	Medium	High	1% of the model runs resulted in at least 1,000 mi^2 of water surface covered by at least 10 g/m^2	Low
3B-2: Water Surface Degree EcoRAR Oiling	Low	Medium	High	The mean area of water contaminated above 10 g/m^2 was 175 mi^2	
3C-1: Shoreline Probability EcoRAR Oiling	Low	Medium	High	65% of the model runs resulted in shoreline oiling of 100 g/m^2	Low
3C-2: Shoreline Degree EcoRAR Oiling	Low	Medium	High	The length of shoreline contaminated by at least 100 g/m^2 was 3 mi	

SECTION 4: SOCIO-ECONOMIC RESOURCES AT RISK

In addition to natural resource impacts, spills from sunken wrecks have the potential to cause significant social and economic impacts. Socio-economic resources potentially at risk from oiling are listed in Table 4-1 and shown in Figures 4-1 and 4-2. The potential economic impacts include disruption of coastal economic activities such as commercial and recreational fishing, boating, vacationing, commercial shipping, and other activities that may become claims following a spill.

Socio-economic resources in the areas potentially affected by a release from the *Prins Willem V* include very highly utilized recreational beaches along the coasts of western Michigan and eastern Wisconsin. Many areas along the entire potential spill zone are widely popular seaside resorts and support recreational activities such as boating, diving, sightseeing, sailing, fishing, and wildlife viewing.

A release could impact shipping lanes that run through the area of impact into ports in Wisconsin, Indiana, and Illinois, and into inland ports in the inland Mississippi River system. There are over 51,000 port vessel calls to the three major ports in Lake Michigan annually. Commercial fishing is somewhat economically important to the region. A release could impact fishing fleets where regional commercial landings for 2009 exceeded $7.2 million.

In addition to the ESI atlases, the Geographic Response Plans within the Area Contingency Plans prepared by the Area Committee for each U.S. Coast Guard Sector have detailed information on important socio-economic resources at risk and should be consulted.

Spill response costs for a release of oil from the *Prins Willem V* would be dependent on volume of oil released and specific areas impacted. The specific shoreline impacts and spread of the oil would determine the response required and the costs for that response.

Table 4-1: Socio-economic resources at risk from a release of oil from the *Prins Willem V*.

Resource Type	Resource Name	Economic Activities
Shore Communities	Benton Harbor, MI Chicago, IL Evanston, IL Grand Haven, MI Hagar Shores, MI Highland Park, IL Kenosha, WI Lake Bluff, IL Lake Forest, IL Ludington, MI Milwaukee, WI Muskegon, MI Norton Shores, MI Pentwater, MI Port Washington, WI Racine, WI Saugatuck, MI Sheboygan, WI	Potentially affected lake-front communities in Wisconsin, Illinois, and Michigan provide recreational activities (e.g., swimming, boating, recreational fishing, wildlife viewing, nature study, sports, dining, camping, and amusement parks) with substantial income for local communities and state tax income. Many of these recreational activities are limited to or concentrated into the late spring through the early fall months.

Resource Type	Resource Name	Economic Activities
	South Haven, MI Stony Lake, MI Waukegan, IL	
State Parks	Charles Mears State Park, MI Duck Lake State Park, MI Fischer Creek State Recreation Area, WI Grand Haven State Park, MI Grand Mere State Park, MI Harrington Beach State Park, WI Holland State Park, MI Kohler-Andrae State Park, WI Lakeshore State Park, WI Ludington State Park, MI Muskegon State Park, MI PJ Hoffmaster State Park, MI Saugatuck Dunes State Park, MI Silver Lake State Park, MI Van Buren State Park, MI	Coastal state parks are significant recreational resources for the public (e.g., swimming, boating, recreational fishing, wildlife viewing, nature study, sports, dining, camping, and amusement parks). They provide income to the states. State parks in Wisconsin, Illinois, and Michigan are potentially impacted. There are also many municipal parks. Many of these recreational activities are limited to or concentrated into the late spring through the early fall months.
Commercial Fishing	A number of fishing fleets use Lake Michigan for commercial fishing purposes.	
	Michigan	Total Landings (2009): $4.6M
	Wisconsin	Total Landings (2009): $2.6M
Ports	There are a number of significant commercial ports in the Pacific Northwest that could potentially be impacted by spillage and spill response activities.	
	Milwaukee, WI	3,476 port calls annually
	Chicago, IL	41,213 port calls annually
	Indiana-Burns Harbor	6,546 port calls annually
Power Plants	Palisades Nuclear Generating Station, MI Donald C. Cook Nuclear Generating Station, MI Ludington Power Plant, MI Port Washington Generating Station, WI Edgewater Generating Station, WI Valley Power Plant, WI Oak Creek Power Plant, WI Waukegan Power Station, IL Fisk Generating Station, IL Crawford Generating Station, IL	Industrial water intakes for several power generating plants are located on Lake Michigan.

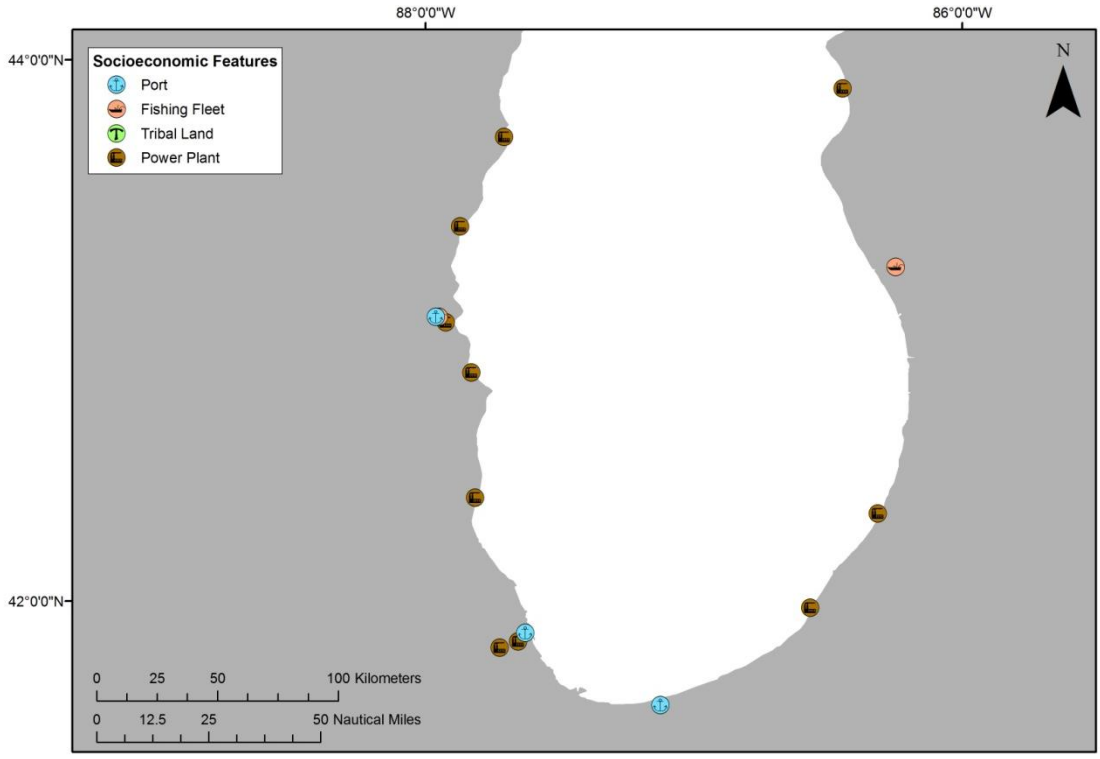


Figure 4-1: Tribal lands, power plants, ports, and commercial fishing fleets at risk from a release from the *Prins Willem V*. (Note that there are no tribal lands at risk.)

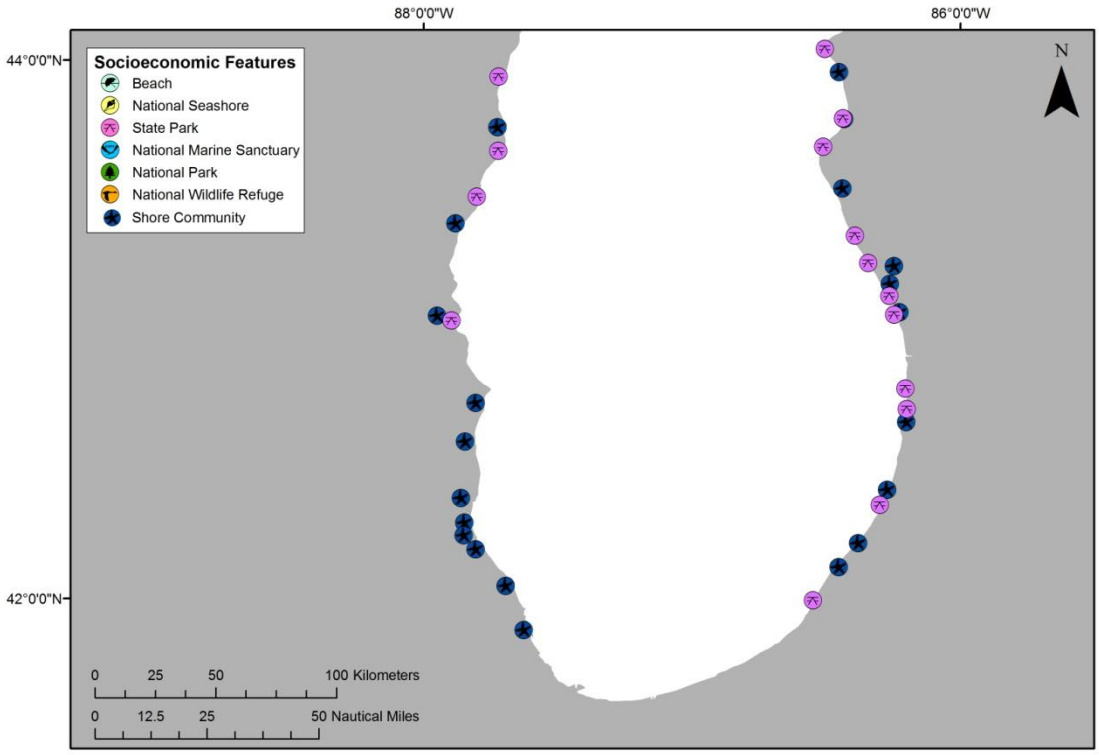


Figure 4-2: Shore communities, coastal state parks, Federal protected areas, and shore communities at risk from a release from the *Prins Willem V*.

Socio-Economic Risk Factors

Risk Factor 4: Impacts to Socio-economic Resources at Risk (SRAR)

Socio-economic resources at risk (SRAR) include potentially impacted resources that have some economic value, including commercial and recreational fishing, tourist beaches, private property, etc. All impact factors are evaluated for both the Worst Case and the Most Probable Discharge oil release from the wreck. Risk factors for socio-economic resources at risk are divided into three categories:

- **Water Column:** Impacts to the water column and to economic resources in the water column (i.e., fish and invertebrates that have economic value);
- **Water Surface:** Impacts to the water surface and resources on the water surface (i.e., boating and commercial fishing); and
- **Shoreline:** Impacts to the shoreline and resources on the shoreline (i.e., beaches, real property).

The impacts from an oil release from the wreck would depend greatly on the direction in which the oil slick moves, which would, in turn, depend on wind direction and currents at the time of and after the oil release. Impacts are characterized in the risk analysis based on the likelihood of any measurable impact, as well as the degree of impact that would be expected if there were one. The measure of the degree of impact is based on the median case for which there is at least some impact. The median case is the "middle case" – half of the cases with significant impacts have less impact than this case, and half have more.

For each of the three socio-economic resources at risk categories, risk is classified with regard to:

- The **probability of oiling** over a certain threshold (i.e., the likelihood that there will be exposure to socio-economic resources over a certain minimal amount known to cause impacts); and
- The **degree of oiling** (the magnitude or amount of that exposure over the threshold known to cause impacts).

As a reminder, the socio-economic impact thresholds are: 1 ppb aromatics for water column impacts; 0.01 g/m^2 for water surface impacts; and 1 g/m^2 for shoreline impacts.

In the following sections, the definition of low, medium, and high for each socio-economic risk factor is provided. Also, in the text classification for the *Prins Willem V,* shading indicates the degree of risk for the WCD release of 3,000 bbl and a border indicates degree of risk for the Most Probable Discharge of 300 bbl of light fuel.

Risk Factor 4A-1: Water Column: Probability of Oiling of SRAR

This risk factor reflects the probability that at least 0.2 mi^2 of the upper 33 feet of the water column would be contaminated with a high enough concentration of oil to cause socio-economic impacts. The threshold for water column impact to socio-economic resources at risk is an oil concentration of 1 ppb (i.e., 1 part oil per one billion parts water). At this concentration and above, one would expect impacts and potential tainting to socio-economic resources (e.g., fish and shellfish) in the water column; this concentration is used as a screening threshold for both the ecological and socio-economic risk factors.

The three risk scores for oiling are:

- **Low Oiling Probability:** Probability = <10%
- **Medium Oiling Probability:** Probability = 10 – 50%
- **High Oiling Probability:** Probability > 50%

Risk Factor 4A-2: Water Column Degree of Oiling of SRAR

The degree of oiling of the water column reflects the total amount of oil that would affect the water column in the event of a discharge from the vessel. The three categories of impact are:

- **Low Impact:** impact on less than 0.2 mi^2 of the upper 33 feet of the water column at the threshold level
- **Medium Impact:** impact on 0.2 to 200 mi^2 of the upper 33 feet of the water column at the threshold level
- **High Impact:** impact on more than 200 mi^2 of the upper 33 feet of the water column at the threshold level

The *Prins Willem V* is classified as High Risk for oiling probability and Medium Risk for degree of oiling for water column socio-economic resources for the WCD of 3,000 bbl because 100% of the model runs resulted in contamination of more than 0.2 mi^2 of the upper 33 feet of the water column above the threshold of 1 ppb aromatics, and the mean volume of water contaminated was 74 mi^2 of the upper 33 feet of the water column. For the Most Probable Discharge of 300 bbl, the *Prins Willem V* is classified as High Risk for oiling probability for water column socio-economic resources because 89% of the model runs resulted in contamination of more than 0.2 mi^2 of the upper 33 feet of the water column above the threshold of 1 ppb aromatics. It was classified as Medium Risk for degree of oiling because the mean volume of water contaminated was 8 mi^2 of the upper 33 feet of the water column.

Risk Factor 4B-1: Water Surface Probability of Oiling of SRAR

This risk factor reflects the probability that at least 1,000 mi^2 of the water surface would be affected by enough oil to cause impacts to socio-economic resources. The three risk scores for oiling are:

- **Low Oiling Probability:** Probability = <10%
- **Medium Oiling Probability:** Probability = 10 – 50%
- **High Oiling Probability:** Probability > 50%

The threshold level for water surface impacts to socio-economic resources at risk is 0.01 g/m^2 (i.e., 0.01 grams of floating oil per square meter of water surface). At this concentration and above, one would expect impacts to socio-economic resources on the water surface.

Risk Factor 4B-2: Water Surface Degree of Oiling of SRAR

The degree of oiling of the water surface reflects the total amount of oil that would affect the water surface in the event of a discharge from the vessel. The three categories of impact are:

- **Low Impact:** less than 1,000 mi^2 of water surface impact at the threshold level
- **Medium Impact:** 1,000 to 10,000 mi^2 of water surface impact at the threshold level
- **High Impact:** more than 10,000 mi^2 of water surface impact at the threshold level

The *Prins Willem V* is classified as High Risk for oiling probability and Medium Risk for degree of oiling for water surface socio-economic resources for the WCD because 52% of the model runs resulted in at least 1,000 mi^2 of the water surface affected above the threshold of 0.01 g/m^2, and the mean area of water contaminated was 2,000 mi^2. The *Prins Willem V* is classified as Medium Risk for oiling probability for water surface socio-economic resources for the Most Probable Discharge because 34% of the model runs resulted in at least 1,000 mi^2 of the water surface affected above the threshold of 0.01 g/m^2. It is classified as Low Risk for degree of oiling because the mean area of water contaminated was 700 mi^2.

Risk Factor 4C: Shoreline Impacts to SRAR

The impacts to different types of shorelines vary based on economic value. In this risk analysis, shorelines have been weighted by their degree of sensitivity to oiling. Sand beaches are the most economically valued shorelines (weighted as "3" in the impact analysis), rocky and gravel shores are moderately valued (weighted as "2"), and wetlands are the least economically valued shorelines (weighted as "1"). Note that these values differ from the ecological values of these three shoreline types.

Risk Factor 4C-1: Shoreline Probability of Oiling of SRAR

This risk factor reflects the probability that the shoreline would be coated by enough oil to cause impacts to shoreline users. The threshold for impacts to shoreline SRAR is 1 g/m^2 (i.e., 1 gram of oil per square meter of shoreline). The three risk scores for oiling are:

- **Low Oiling Probability:** Probability = <10%
- **Medium Oiling Probability:** Probability = 10 – 50%
- **High Oiling Probability:** Probability > 50%

Risk Factor 4C-2: Shoreline Degree of Oiling of SRAR

The degree of oiling of the shoreline reflects the total amount of oil that would affect the shoreline in the event of a discharge from the vessel. The three categories of impact are:

- **Low Impact:** less than 10 miles of shoreline impacted at threshold level
- **Medium Impact:** 10 - 100 miles of shoreline impacted at threshold level
- **High Impact:** more than 100 miles of shoreline impacted at threshold level

The *Prins Willem V* is classified as High Risk for oiling probability for shoreline socio-economic resources for the WCD because 95% of the model runs resulted in shorelines affected above the threshold of 1 g/m^2. It is classified as Medium Risk for degree of oiling because the mean length of weighted shoreline contaminated was 23 miles. The *Prins Willem V* is classified as High Risk for oiling probability and Low Risk for degree of oiling for shoreline socio-economic resources for the Most Probable Discharge as 83% of the model runs resulted in shorelines affected above the threshold of 1 g/m^2, and the mean length of weighted shoreline contaminated was 7 miles.

Considering the modeled risk scores and the socio-economic resources at risk, the socio-economic risk from potential releases of the WCD of 3,000 bbl of light fuel from the *Prins Willem V* is summarized as listed below and indicated in the far-right column in Table 4-2:

- Water column resources – High, because the area of water column impacted includes areas with water intakes for power plants
- Water surface resources – High, because a large area of water surface would be impacted offshore in areas with shipping lanes where there are few alternatives for routing. It should be noted that oil on the surface will not be continuous but rather be broken and patchy and in the form of sheens and streamers
- Shoreline resources – Medium, because a moderate length of shoreline would be impacted in areas with high-value and sensitive resources

For the Most Probable Discharge of 300 bbl, the socio-economic risk from potential releases of light fuel oil from the *Prins Willem V* for water column resources is Medium, to water surface resources is Medium, and to shoreline resources is Medium.

Table 4-2: Socio-economic risk factor ranks for the **Worst Case Discharge of 3,000 bbl** of light fuel oil from the *Prins Willem V*.

Risk Factor	Risk Score			Explanation of Risk Score	Final Score
4A-1: Water Column Probability SRAR Oiling	Low	Medium	High	100% of the model runs resulted in at least 0.2 mi^2 of the upper 33 feet of the water column contaminated above 1 ppb aromatics	High
4A-2: Water Column Degree SRAR Oiling	Low	Medium	High	The mean volume of water contaminated above 1 ppb was 74 mi^2 of the upper 33 feet of the water column	
4B-1: Water Surface Probability SRAR Oiling	Low	Medium	High	52% of the model runs resulted in at least 1,000 mi^2 of water surface covered by at least 0.01 g/m^2	High
4B-2: Water Surface Degree SRAR Oiling	Low	Medium	High	The mean area of water contaminated above 0.01 g/m^2 was 1,992 mi^2	
4C-1: Shoreline Probability SRAR Oiling	Low	Medium	High	95% of the model runs resulted in shoreline oiling of 1 g/m^2	Med
4C-2: Shoreline Degree SRAR Oiling	Low	Medium	High	The length of shoreline contaminated by at least 1 g/m^2 was 23 mi	

For the Most Probable Discharge of 300 bbl, the socio-economic risk from potential releases of light fuel from the *Prins Willem V* is summarized as listed below and indicated in the far-right column in Table 4-3:

- Water column resources – Medium, because a small area of water column would be impacted in areas with water intakes for power plants
- Water surface resources – Medium, because a moderate area of water surface would be impacted offshore in areas with shipping lanes where there are few alternatives for routing. It should be noted that oil on the surface will not be continuous but rather be broken and patchy and in the form of sheens and streamers
- Shoreline resources – Low, because a small length of shoreline would be impacted in areas with high-value and sensitive resources.

Table 4-3: Socio-economic risk factor ranks for the **Most Probable Discharge of 300 bbl** of light fuel oil from the *Prins Willem V*.

Risk Factor	Risk Score			Explanation of Risk Score	Final Score
4A-1: Water Column Probability SRAR Oiling	Low	Medium	High	89% of the model runs resulted in at least 0.2 mi^2 of the upper 33 feet of the water column contaminated above 1 ppb aromatics	Med
4A-2: Water Column Degree SRAR Oiling	Low	**Medium**	High	The mean volume of water contaminated above 1 ppb was 8 mi^2 of the upper 33 feet The mean volume of water contaminated of the water column	
4B-1: Water Surface Probability SRAR Oiling	Low	**Medium**	High	34% of the model runs resulted in at least 1,000 mi^2 of water surface covered by at least 0.01 g/m^2	Med
4B-2: Water Surface Degree SRAR Oiling	**Low**	Medium	High	The mean area of water contaminated above 0.01g/m^2 was 696 mi^2	
4C-1: Shoreline Probability SRAR Oiling	Low	Medium	High	83% of the model runs resulted in shoreline oiling of 1 g/m^2	Low
4C-2: Shoreline Degree SRAR Oiling	**Low**	Medium	High	The length of shoreline contaminated by at least 1 g/m^2 was 7 mi	

SECTION 5: OVERALL RISK ASSESSMENT AND RECOMMENDATIONS FOR ASSESSMENT, MONITORING, OR REMEDIATION

The overall risk assessment for the *Prins Willem V* is comprised of a compilation of several components that reflect the best available knowledge about this particular site. Those components are reflected in the previous sections of this document and are:

- Vessel casualty information and how the site formation processes have worked on this particular vessel
- Ecological resources at risk
- Socio-economic resources at risk
- Other complicating factors (war graves, other hazardous cargo, etc.)

Table 5-1 summarizes the screening-level risk assessment scores for the different risk factors, as discussed in the previous sections. The ecological and socio-economic risk factors are presented as a single score for water column, water surface, and shoreline resources as the scores were consolidated for each element. For the ecological and socio-economic risk factors each has two components, probability and degree. Of those two, degree is given more weight in deciding the combined score for an individual factor, e.g., a high probability and medium degree score would result in a medium overall for that factor.

In order to make the scoring more uniform and replicable between wrecks, a value was assigned to each of the 7 criteria. This assessment has a total of 7 criteria (based on table 5-1) with 3 possible scores for each criteria (L, M, H). Each was assigned a point value of L=1, M=2, H=3. The total possible score is 21 points, and the minimum score is 7. The resulting category summaries are:

Low Priority	7-11
Medium Priority	12-14
High Priority	15-21

For the Worst Case Discharge, *Prins Willem V* scores Medium with 14 points; for the Most Probable Discharge, *Prins Willem V* scores Low with 11 points. Under the National Contingency Plan, the U.S. Coast Guard and the Regional Response Team have the primary authority and responsibility to plan, prepare for, and respond to oil spills in U.S. waters. Based on the technical review of available information, NOAA proposes the following recommendations for the *Prins Willem V*. The final determination of what type of action, if any, rests with the U.S. Coast Guard.

Prins Willem V	**Possible NOAA Recommendations**
	Wreck should be considered for further assessment to determine the vessel condition, amount of oil onboard, and feasibility of oil removal action
	Location is unknown; Use surveys of opportunity to attempt to locate this vessel and gather more information on the vessel condition
✓	Conduct active monitoring to look for releases or changes in rates of releases
✓	Be noted in the Area Contingency Plans so that if a mystery spill is reported in the general area, this vessel could be investigated as a source
✓	Conduct outreach efforts with the technical and recreational dive community as well as commercial and recreational fishermen who frequent the area, to gain awareness of changes in the site

Table 5-1: Summary of risk factors for the *Prins Willem V*.

Vessel Risk Factors		Data Quality Score	Comments	Risk Score
Pollution Potential Factors	A1: Oil Volume (total bbl)	Low	Maximum of 3,000 bbl, not reported to be leaking	**Med**
	A2: Oil Type	High	Bunker oil is diesel oil, a Group II oil type	
	B: Wreck Clearance	High	Vessel not reported as cleared	
	C1: Burning of the Ship	High	No fire was reported	
	C2: Oil on Water	High	No oil was reported on the water	
	D1: Nature of Casualty	High	Collision	
	D2: Structural Breakup	High	The vessel remains in one contiguous piece	
Archaeological Assessment	Archaeological Assessment	Low	The best sinking assessment still comes from the U.S. Coast Guard so a detailed archaeological assessment was not prepared	**Not Scored**
Operational Factors	Wreck Orientation	High	Resting on its starboard side	**Not Scored**
	Depth	High	90 ft	
	Visual or Remote Sensing Confirmation of Site Condition	High	The wreck is a popular dive site	
	Other Hazardous Materials Onboard	High	No	
	Munitions Onboard	High	No	
	Gravesite (Civilian/Military)	High	No	
	Historical Protection Eligibility (NHPA/SMCA)	High	NHPA	
			WCD	**Most Probable**
Ecological Resources	3A: Water Column Resources	High	Areas above thresholds mostly offshore in areas without known concentrations of sensitive resources	**Med** / **Low**
	3B: Water Surface Resources	High	Relatively small offshore areas at risk	**Low** / **Low**
	3C: Shore Resources	High	Limited shoreline impacts likely	**Low** / **Low**
Socio-Economic Resources	4A: Water Column Resources	High	Impacted areas include water intakes for power plants	**High** / **Med**
	4B: Water Surface Resources	High	Large area of water surface would be impacted offshore in areas with shipping lanes where there are few alternatives for routing	**High** / **Med**
	4C: Shore Resources	High	Moderate length of shoreline would be impacted in areas with high-value and sensitive resources	**Med** / **Low**
Summary Risk Scores				**14** / **11**