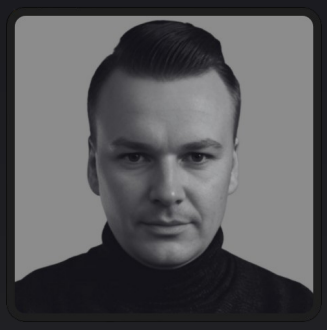

VOLODYMYR STETSENKO

PasswordStore

Security Review

Version 1.0 | November 2025

Securing the future of decentralized finance

PasswordStore Security Review Details

2	0	1
High Findings	Medium Findings	Informational

Review Period:	**November 24–26, 2025**
Report Date:	**November 26, 2025**
Version:	**1.0**
Commit:	`7d55682ddc4301a7b13ae9413095feffd9924566`
Methods:	Manual Review, Static Analysis

Contents

About Volodymyr Stetsenko

Volodymyr Stetsenko is an independent smart contract security researcher focused on **manual auditing**, **automated and static analysis**, and **property-based / fuzz testing and formal verification** of EVM-based protocols. His work emphasizes rigorous code review, careful reasoning about protocol assumptions, and identifying high-impact logic, economic, and architectural weaknesses.

I'm continuously sharpening my expertise through **deep study**, **public audit practice**, and transparent documentation of my methods. My approach combines manual inspection with a tool-driven workflow — including static analyzers (e.g., Slither), fuzzers and property-based testing (e.g., Echidna, Foundry fuzzing), symbolic checks, invariant assertions, and formal verification where appropriate — to ensure comprehensive coverage of both functional and economic risk vectors.

While no one can guarantee 100% security, I commit to giving your project my full attention, thorough analysis, and maximum effort to uncover risks and strengthen your protocol.

Volodymyr Stetsenko

Independent Security Researcher

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Disclaimer

Important Notice

Volodymyr Stetsenko makes all effort to find as many vulnerabilities in the code in the given time period, but holds no responsibilities for the findings provided in this document. A security audit by the auditor is not an endorsement of the underlying business or product.

A smart contract security review **cannot verify the complete absence of vulnerabilities**. This is a time, resource, and expertise-bound effort. **No guarantee of 100% security** is provided, regardless of whether any issues were identified.

The audit was **time-boxed** and focused solely on the security aspects of the Solidity implementation within the defined scope. This report is provided **"AS IS"** without warranty of any kind.

Recommended post-audit measures: subsequent independent reviews, bug bounty programs, on-chain monitoring, and formal verification of critical invariants.

Scope Limitations

The following areas are **outside the scope** of this security assessment unless explicitly stated:

- Business logic beyond security implications
- Economic model and tokenomics analysis
- Frontend/backend application security
- Third-party integrations and dependencies
- Deployment scripts and infrastructure
- Future code changes and upgrades

Risk Classification

Severity Matrix

	Impact: High	Impact: Medium	Impact: Low
Likelihood: High	Critical	High	Medium
Likelihood: Medium	High	Medium	Low
Likelihood: Low	Medium	Low	Low

Impact

- **High** — leads to a significant material loss of assets in the protocol or significantly harms a group of users.
- **Medium** — leads to a moderate material loss of assets in the protocol or moderately harms a group of users.
- **Low** — leads to a minor material loss of assets in the protocol or harms a small group of users.

Likelihood

- **High** — attack path is possible with reasonable assumptions that mimic on-chain conditions, and the cost of the attack is relatively low compared to the amount of funds that can be stolen or lost.
- **Medium** — only a conditionally incentivized attack vector, but still relatively likely.
- **Low** — has too many or too unlikely assumptions or requires a significant stake by the attacker with little or no incentive.

Protocol Summary

4.1 Introduction

PasswordStore is a smart contract protocol designed to allow users to store and retrieve passwords on the Ethereum blockchain. The protocol's primary objective is to provide a decentralized password management solution where only the authorized owner can access stored credentials.

4.2 Architecture

The protocol consists of a single contract with the following components:

- **Storage:** Owner address (`s_owner`) and password string (`s_password`) stored in contract state
- **Access Control:** Owner-only restrictions on password operations (intended)
- **Events:** Password change notification via `SetNewPassword` event

4.3 Functions

Function	Visibility	Description
`setPassword()`	external	Set a new password (intended: owner only)
`getPassword()`	external view	Retrieve stored password (owner only)

Executive Summary

A time-boxed security review of the **PasswordStore** protocol was conducted by **Volodymyr Stetsenko**, with a focus on the security aspects of the application's smart contracts implementation.

PasswordStore is a smart contract designed to allow users to store and retrieve passwords on the Ethereum blockchain. The protocol's primary objective is to provide a decentralized password management solution where only the authorized owner can access stored credentials.

5.1 Audit Overview

Attribute	Details
Protocol	PasswordStore
Auditor	Volodymyr Stetsenko
Language	Solidity 0.8.18
Blockchain	Ethereum
Methodology	Manual Code Review, Static Analysis
Review Period	November 24–26, 2025
Commit Hash	`7d55682ddc4301a7b13ae9413095feffd9924566`

5.2 Scope

Contract	Path	nSLOC
`PasswordStore.sol`	`src/PasswordStore.sol`	∼20
	Total	**∼20**

5.3 Findings Summary

Severity	Open	Acknowledged	Resolved	Total
Critical	0	0	0	**0**
High	2	0	0	**2**
Medium	0	0	0	**0**
Low	0	0	0	**0**
Informational	1	0	0	**1**
Total	**3**	**0**	**0**	**3**

This summary table consolidates all findings recorded during the assessment, grouping them by severity level and current remediation status. The review identified two high-severity issues and one informational observation, with no other severities reported. All findings remain in an open state at the time of reporting.

Findings

6.1 High Severity

HIGH

[H-1] Password stored on-chain is visible to anyone, not just the owner

Severity: HIGH Status: Open

Location: `PasswordStore.sol` Variable: `s_password`

Description

The `PasswordStore::s_password` variable is stored on-chain and marked as `private`. However, all data stored on-chain is publicly visible to anyone, regardless of Solidity visibility modifiers. The `private` keyword only prevents other contracts from accessing the variable, but does not prevent reading the data directly from the blockchain storage.

Impact

Anyone can read the password directly from the blockchain, completely defeating the purpose of the protocol. The core invariant *"Others should not be able to access the password"* is broken.

Proof of Concept

The test case below demonstrates how anyone can read the password directly from the blockchain. We use Foundry's `cast` tool to read directly from the storage of the contract, without being the owner.

Step 1: Create a locally running chain

```
make anvil
```

Step 2: Deploy the contract to the chain

```
make deploy
```

Step 3: Understanding Storage Slots

```
contract PasswordStore {
    address private s_owner;      // Storage slot 0
    string private s_password;    // Storage slot 1
}
```

The first variable `s_owner` is in slot 0, and the second variable `s_password` is in slot 1.

Step 4: Read the storage slot
We use `1` because that's the storage slot of `s_password` in the contract. Replace `<ADDRESS_HERE>` with your actual contract address from Step 2:

```
cast storage <ADDRESS_HERE> 1 --rpc-url http://127.0.0.1:8545
```

You'll get an output that looks like this:

```
0x6d7950617373776f726400000000000000000000000000000000000000000014
```

Step 5: Decode the hex to readable string

```
cast parse-bytes32-string 0
   x6d7950617373776f726400000000000000000000000000000000000000000014
```

And get an output of:

```
myPassword
```

Recommended Mitigation

Due to the transparent nature of blockchain, storing passwords on-chain is fundamentally insecure. All data stored on-chain is publicly readable, regardless of Solidity visibility modifiers. The overall architecture should be reconsidered. Possible approaches:

1. **Store password hashes instead of passwords** — This allows verification without exposing the actual password. Users can prove they know the password without revealing it.

2. **Use off-chain storage** — Store passwords in an encrypted database off-chain, and use the blockchain only for access control logic.

3. **Reconsider the use case** — Evaluate whether this functionality requires blockchain technology, as password storage conflicts with blockchain's core transparent properties.

Recommended: Implement password hashing (Option 1) if retrieval isn't required, or move to off-chain storage (Option 2) if users need to retrieve passwords.

HIGH

[H-2] `PasswordStore::setPassword` has no access controls, meaning a non-owner could change the password

Severity: HIGH Status: Open

Location: `PasswordStore.sol` Function: `setPassword()`

Description

The `PasswordStore::setPassword` function is set to be an `external` function, however, the natspec of the function and purpose of the smart contract indicate that *"This function allows only the owner to set a new password."*

```
function setPassword(string memory newPassword) external {
    // @audit - There are no access controls
    s_password = newPassword;
    emit SetNewPassword();
}
```

Impact

Anyone can set/change the stored password, severely breaking the contract's intended functionality.

Proof of Concept

Add the following test to `PasswordStore.t.sol` file:

```
function test_anyone_can_set_password(address randomAddress) public
    {
    vm.assume(randomAddress != owner);
    vm.prank(randomAddress);
    string memory expectedPassword = "myPassword";
    passwordStore.setPassword(expectedPassword);

    vm.prank(owner);
    string memory actualPassword = passwordStore.getPassword();
    assertEq(actualPassword, expectedPassword);
}
```

Run the test:

```
forge test --mt test_anyone_can_set_password
```

The test passes, proving that any non-owner address can successfully change the password.

Recommended Mitigation

Add an access control check to the `PasswordStore::setPassword` function:

```
function setPassword(string memory newPassword) external {
    if (msg.sender != s_owner) {
        revert PasswordStore__NotOwner();
    }
    s_password = newPassword;
    emit SetNewPassword();
}
```

6.2 Informational

INFORMATIONAL

[I-1] The `PasswordStore::getPassword` natspec indicates a parameter that doesn't exist, causing the natspec to be incorrect

Severity: INFO Status: Open

Location: `PasswordStore.sol` Function: `getPassword()`

Description

The `PasswordStore::getPassword` function signature is `getPassword()` which takes no parameters, however the natspec indicates it should be `getPassword(string)` and describes a `newPassword` parameter that doesn't exist in the function.

```
/*
 * @notice This allows only the owner to retrieve the password.
 * @param newPassword The new password to set.   // INCORRECT
 */
function getPassword() external view returns (string memory) {
    if (msg.sender != s_owner) {
        revert PasswordStore__NotOwner();
    }
    return s_password;
}
```

Impact

The natspec is incorrect, which can lead to confusion for developers and auditors reviewing the code.

Recommended Mitigation

Remove the incorrect natspec line:

```
/*
 * @notice This allows only the owner to retrieve the password.
 * @return The stored password string.
 */
function getPassword() external view returns (string memory) {
    if (msg.sender != s_owner) {
        revert PasswordStore__NotOwner();
    }
    return s_password;
}
```

Conclusion

7.1 Summary

This security review identified **2 High severity** and **1 Informational** findings in the PasswordStore protocol. The High severity issues represent fundamental architectural flaws that completely undermine the protocol's security objectives.

2 HIGH SEVERITY

1 INFO

7.2 Key Takeaways

1. **Blockchain Transparency** — All data stored on-chain is publicly readable. The Solidity `private` keyword does not provide data confidentiality—it only restricts contract-level access.

2. **Access Control is Critical** — Every state-modifying function must implement proper access control. Documentation stating access restrictions is not a substitute for code enforcement.

3. **Architecture Matters** — Some use cases are fundamentally incompatible with blockchain transparency. Password storage in plaintext on a public blockchain violates basic security principles.

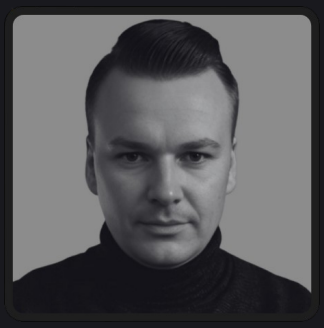
7.3 Recommendations

#	Priority	Action Item
1	HIGH	Redesign architecture — do not store sensitive data on-chain
2	HIGH	Implement access control on `setPassword()` function
3	MEDIUM	Consider hash-based password verification if needed
4	INFO	Fix NatSpec documentation errors
5	INFO	Conduct follow-up security review after fixes

Volodymyr Stetsenko

Lead Security Researcher

November 26, 2025



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