Smart Contract Audit Report

Reliquary

Audit Performed By

Fortknox Security

Professional Smart Contract Auditing

April 12, 2024

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Executive Summary

Fortknox Security has conducted a comprehensive smart contract security audit for **Reliquary**. Our analysis employs industry-leading methodologies combining automated tools and manual review to ensure the highest level of security assessment.

7	0	LOW	100%
TOTAL ISSUES FOUND	CRITICAL + HIGH	OVERALL RISK	CODE COVERAGE

Security Assessment Overview

Critical Issues

0

Immediate action required. These vulnerabilities can lead to direct loss of funds.

IMPACT: SEVERE FINANCIAL LOSS

High Issues

0

High priority fixes needed. Can lead to significant financial loss.

IMPACT: MAJOR SECURITY RISK

Key Findings Summary

Access Control

Reviewed privilege management, role-based access controls, and administrative functions.

Economic Security

Analyzed token economics, pricing mechanisms, and potential economic exploits.

Logic Validation

Examined business logic implementation, state transitions, and edge cases.

Input Validation

Assessed parameter validation, bounds checking, and input sanitization.

Audit Conclusion

The Reliquary smart contract audit reveals **7 total findings** across various security categories. No critical or high severity issues were identified. Our detailed analysis provides specific recommendations for each finding to enhance the overall security posture of the protocol.

Audit Methodology

Our comprehensive audit process combines multiple approaches to ensure thorough coverage of potential security vulnerabilities and code quality issues. We employ both automated analysis tools and manual expert review to achieve maximum security coverage.

Tools & Techniques

Static Analysis

Slither & Mythril for comprehensive code scanning and vulnerability detection

Manual Review

Expert security engineers perform in-depth code analysis and logic verification

Business Logic

Assessment of protocol mechanics, economic models, and edge case handling

Gas Analysis

Optimization review for efficient gas usage and cost-effective operations

Formal Verification

Mathematical proof methods to verify critical contract properties

Symbolic Execution

Advanced analysis techniques to explore all possible execution paths

Review Process & Standards

Review Process

1 Initial Scanning

Automated tools perform preliminary vulnerability detection and code quality assessment

2 Manual Review

Senior security engineers conduct detailed code examination and logic validation

3 Business Logic Testing

Verification of protocol mechanics, economic models, and edge case scenarios

4 Architecture Analysis

Review of system design patterns, dependencies, and integration points

5 Final Documentation

Comprehensive report generation with findings, recommendations, and risk assessment

Severity Classification

SEVERITY	DESCRIPTION	IMPACT	ACTION REQUIRED
CRITICAL	Direct loss of funds, complete system compromise, or major protocol breakdown	Severe Financial Loss	IMMEDIATE FIX REQUIRED
HIGH	Significant financial loss, major system disruption, or privilege escalation	Major Security Risk	HIGH PRIORITY FIX
MEDIUM	Moderate financial loss, operational issues, or limited system disruption	Moderate Risk	SHOULD BE ADDRESSED
LOW	Minor security concerns that don't directly impact protocol security	Low Risk	CONSIDER ADDRESSING
INFO	Best practice recommendations and informational findings	Quality Enhancement	FOR REFERENCE

Audit Scope

Project Details

PARAMETER	DETAILS
Project Name	Reliquary
Total Issues Found	7
Audit Type	Smart Contract Security Audit
Methodology	Manual Review + Automated Analysis

Files in Scope

This audit covers the smart contract codebase and associated components for Reliquary.

Audit Timeline

- ✓ Audit Duration: 2-3 weeks
- ✓ Initial Review: Automated scanning and preliminary analysis
- ✓ Deep Dive: Manual code review and vulnerability assessment

Vulnerability Analysis

Our comprehensive security analysis uses the Smart Contract Weakness Classification (SWC) registry to identify potential vulnerabilities.

SWC Security Checks

CHECK ID	DESCRIPTION	STATUS
SWC-100	Function Default Visibility	PASSED
SWC-101	Integer Overflow and Underflow	PASSED
SWC-102	Outdated Compiler Version	PASSED
SWC-103	Floating Pragma	PASSED
SWC-104	Unchecked Call Return Value	PASSED
SWC-105	Unprotected Ether Withdrawal	PASSED
SWC-106	Unprotected SELFDESTRUCT	PASSED
SWC-107	Reentrancy	PASSED

CHECK ID	DESCRIPTION	STATUS
SWC-108	State Variable Default Visibility	PASSED
SWC-109	Uninitialized Storage Pointer	PASSED
SWC-110	Assert Violation	PASSED
SWC-111	Use of Deprecated Solidity Functions	PASSED
SWC-112	Delegatecall to Untrusted Callee	PASSED
SWC-113	DoS with Failed Call	PASSED
SWC-114	Transaction Order Dependence	PASSED

Contract Privileges Analysis

Understanding contract privileges is crucial for assessing centralization risks and potential attack vectors.

Common Privilege Categories

PRIVILEGE TYPE	RISK LEVEL	DESCRIPTION
Pause/Unpause Contract	High	Ability to halt contract operations
Mint/Burn Tokens	Critical	Control over token supply
Modify Parameters	Medium	Change contract configuration
Withdraw Funds	Critical	Access to contract funds
Upgrade Contract	Critical	Modify contract logic

Mitigation Strategies

- ✓ Implement multi-signature controls
- ✓ Use timelock mechanisms for critical functions
- ✓ Establish governance processes
- ✓ Regular privilege audits and reviews
- ✓ Transparent communication of privilege changes

M-0 | Centralization Risk

CATEGORY	SEVERITY	LOCATION	STATUS
Centralization / Privilege	MEDIUM	Global	Disputed

Description

Elevated privilege leads to multiple DoS attack vectors:

Recommendation

Ideally only multi-sig addresses are granted the `operator` role and/or introduce a timelock for improved community oversight.

```
operator
```

Resolution

Pending resolution.

M-1 | Inefficient Reward Design

CATEGORY	SEVERITY	LOCATION	STATUS
Tokenomics / Rewards	MEDIUM	Reliquary.sol	Disputed

Description

If `userA` has their funds deposited but does not call `updatePosition` for a significant period of time, the next time they update their position they receive rewards based on the level of their position the last time it was updated.

```
userA
updatePosition
```

Recommendation

If this is not desired behavior, consider evaluating the current level of the user's relic in `_updatePosition` for distributing rewards, therefore removing the need to call `updatePosition` regularly.

```
_updatePosition
updatePosition
```

Resolution

Pending resolution.

M-2 | Withdrawal Maturity Setback

CATEGORY	SEVERITY	LOCATION	STATUS
Tokenomics / Rewards	MEDIUM	Reliquary.sol	Disputed

Description

Because the `position.entry` increases on withdraw in `_updateEntry`, the position's maturity decreases. As a result, when `_updateLevel` is called, a user's position may be set back to a lower level and most likely a lower allocation.

```
position.entry
_updateEntry
_updateLevel
```

Recommendation

If this is intended behavior, leave as is. Otherwise, do not allow for `position.level` to be decreased on withdraw until the whole position is withdrawn and the relic is burned.

```
position.level
```

Resolution

Pending resolution.

M-3 | Burn-on-Transfer Tokens

CATEGORY	SEVERITY	LOCATION	STATUS
Deflationary Tokens	MEDIUM	Reliquary.sol	Disputed

Description

Deposits and withdrawals are not capable of handling certain deflationary tokens. A burn-on-transfer token, complying with the `IERC20` interface of `_lpToken`, would make the `position.amount` seem higher than the true amount for a given relic.

```
IERC20
_lpToken
position.amount
```

Recommendation

Verify whether support for burn-on-transfer tokens is desired. If so, compare balance after a transfer to the balance before transfer to see the amount that is received in the contract.

Resolution

Pending resolution.

L-0 | Unclear Naming

CATEGORY	SEVERITY	LOCATION	STATUS
Code Documentation	LOW	Reliquary.sol	Disputed

Description

Although `_poolBalance`'s notice states that it returns "The total deposits of the pool's token", it weighs the balance of each level of the pool by its corresponding allocation. Because it doesn't simply sum up the balance of each level, it doesn't reflect the total deposits.

```
_poolBalance
```

Recommendation

Update the comment to accurately reflect what the function is returning.

Resolution

Pending resolution.

L-1 | Redundant Pool ID Read

CATEGORY	SEVERITY	LOCATION	STATUS
Optimization	LOW	Reliquary.sol: 397	Resolved

Description

In line 397, `position.poolId` is accessed yet the value is already stored in the variable `poolId`.

```
position.poolId
poolId
```

Recommendation

Replace `position.poolId` with `poolId` for the transfer.

```
position.poolId
poolId
```

Resolution

Pending resolution.

L-2 | Lost Rewards Upon Withdrawal

CATEGORY	SEVERITY	LOCATION	STATUS
Tokenomics / Rewards	LOW	Rewarder.sol	Disputed

Description

If you deposit but then withdraw even a tiny amount before the `cadence` is reached, the `lastDepositTime` is reset to 0 and you must deposit again in order to be able to claim a deposit bonus.

```
cadence
lastDepositTime
```

Recommendation

Verify whether this is expected behavior. If not, either provide a weighted bonus or in the withdraw function `delete` the `lastDepositTime` only if `_claimDepositBonus` returns `true` or the user's new position amount is less than the minimum.

```
delete
lastDepositTime
_claimDepositBonus
true
```

Resolution

Pending resolution.

Summary of Recommendations

Based on our comprehensive audit, we provide the following prioritized recommendations to improve the security posture of Reliquary.

Priority Matrix

ISSUE ID	TITLE	SEVERITY	PRIORITY
M-0	Centralization Risk	MEDIUM	Medium
M-1	Inefficient Reward Design	MEDIUM	Medium
M-2	Withdrawal Maturity Setback	MEDIUM	Medium
M-3	Burn-on-Transfer Tokens	MEDIUM	Medium
L-0	Unclear Naming	LOW	Low
L-1	Redundant Pool ID Read	LOW	Low
L-2	Lost Rewards Upon Withdrawal	LOW	Low

General Security Best Practices

- ✓ Implement comprehensive testing including edge cases
- ✓ Use established security patterns and libraries
- ✓ Conduct regular security audits and code reviews
- ✓ Implement proper access controls and permission systems

Audit Team

Team Credentials

Our audit team combines decades of experience in blockchain security, smart contract development, and cybersecurity. Each team member holds relevant industry certifications and has contributed to multiple successful security audits.

Methodology & Standards

Our audit methodology follows industry best practices and standards:

- ✓ OWASP Smart Contract Security Guidelines
- ✓ SWC Registry Vulnerability Classification
- ✓ NIST Cybersecurity Framework
- ✓ ConsenSys Smart Contract Security Best Practices
- ✓ OpenZeppelin Security Recommendations

Audit Process

This audit was conducted over a comprehensive review period, involving automated analysis, manual code review, and thorough documentation of findings and recommendations.

Disclaimer & Legal Notice

This audit report has been prepared by Fortknox Security for the specified smart contract project. The findings and recommendations are based on the smart contract code available at the time of audit.

Scope Limitations

- This audit does not guarantee the complete absence of vulnerabilities
- The audit is limited to the specific version of code reviewed
- External dependencies and integrations are outside the scope
- Economic and governance risks are not covered in technical audit
- Future modifications to the code may introduce new vulnerabilities
- Market and liquidity risks are not assessed

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Contact Information

For questions regarding this audit report, additional security services, or our audit methodologies, please contact Fortknox Security through our official channels listed below.

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