CERTIK

Security Assessment

Swell II

Jun 6th, 2022

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Summary

This report has been prepared for Swell Ⅱ to discover issues and vulnerabilities in the source code of the Swell Ⅱ project as well as any contract dependencies that were not part of an officially recognized library. A comprehensive examination has been performed, utilizing Static Analysis and Manual Review techniques.

The auditing process pays special attention to the following considerations:

- Testing the smart contracts against both common and uncommon attack vectors.
- Assessing the codebase to ensure compliance with current best practices and industry standards.
- Ensuring contract logic meets the specifications and intentions of the client.
- Cross referencing contract structure and implementation against similar smart contracts produced by industry leaders.
- Thorough line-by-line manual review of the entire codebase by industry experts.

The security assessment resulted in findings that ranged from critical to informational. We recommend addressing these findings to ensure a high level of security standards and industry practices. We suggest recommendations that could better serve the project from the security perspective:

- Enhance general coding practices for better structures of source codes;
- Add enough unit tests to cover the possible use cases;
- Provide more comments per each function for readability, especially contracts that are verified in public;
- Provide more transparency on privileged activities once the protocol is live.

Overview

Project Summary

Project Name	Swell II
Platform	Ethereum
Language	Solidity
Codebase	https://github.com/SwellNetwork/vault/commits/main/contracts
Commit	db212449126d46da68c8b49d03980382b6d86b36

Audit Summary

Delivery Date	Jun 06, 2022 UTC
Audit Methodology	Static Analysis, Manual Review

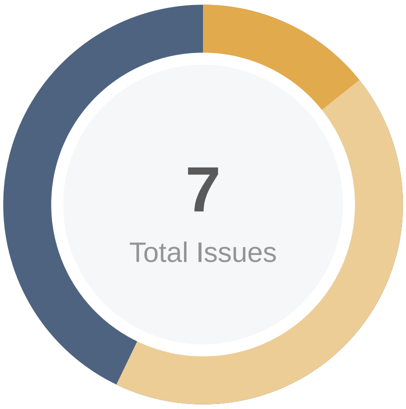
Vulnerability Summary

Vulnerability Level	Total	Pending	Declined	Acknowledged	Mitigated	Partially Resolved	Resolved
Critical	0	0	0	0	0	0	0
Major	0	0	0	0	0	0	0
Medium	1	0	0	0	0	0	1
Minor	3	0	0	3	0	0	0
Informational	3	0	0	1	0	0	2
Discussion	0	0	0	0	0	0	0

Audit Scope

ID	File	SHA256 Checksum
SBV	implementations/SwellBalancerVault.sol	e3b3bad26968e1a01e2d2faf67e17ba4043223cd6fd1d3be8ff3fa36fe8c39b1

Findings



Critical	**0** (0.00%)
Major	**0** (0.00%)
Medium	**1** (14.29%)
Minor	**3** (42.86%)
Informational	**3** (42.86%)
Discussion	**0** (0.00%)

ID	Title	Category	Severity	Status
SBV-01	Incorrect Array Length	Logical Issue	Medium	Resolved
SBV-02	Unknown Implementations	Volatile Code	Minor	Acknowledged
SBV-03	Potential Incorrect Index Of The Asset Token	Logical Issue	Minor	Acknowledged
SBV-04	Different Interfaces With `rari-capital`	Logical Issue	Minor	Acknowledged
SBV-05	Unlocked Compiler Version	Language Specific	Informational	Resolved
SBV-06	Missing Zero Address Validation	Coding Style	Informational	Resolved
SBV-07	Mathematical Verification	Logical Issue	Informational	Acknowledged

SBV-01 | Incorrect Array Length

Category	Severity	Location	Status
Logical Issue	Medium	implementations/SwellBalancerVault.sol: 121~122	Resolved

Description

The lengths of the array `tokens` and `tokenAmounts` are incorrect, they should be `tokensFromPool.length`.

```
IAsset[] memory tokens = new IAsset[](2);
uint256[] memory tokenAmounts = new uint256[](2);
```

Recommendation

We recommend reviewing the logic again and fix the length of the array.

Alleviation

The team heeded our advice and resolved this issue in commit `06c89f2c2ed18b93b6f0eb4cf0f183166af8877a`.

SBV-02 | Unknown Implementations

Category	Severity	Location	Status
Volatile Code	Minor	implementations/SwellBalancerVault.sol	Acknowledged

Description

The project is using the underlying entities `IVault`, `IWeightedPool`, and inherits the abstract contracts `ERC4626` and `WeightedMath` and uses util lib `FixedPointMathLib`.

However, the real implementations of these interfaces and abstract contracts and libs are out of the scope of this audit.

The scope of the audit treats these entities as black boxes and assumes their functional correctness. The related codes are not in the scope of this audit.

Recommendation

We understand that the business logic of this protocol requires interaction with `IVault`, `IWeightedPool`, `ERC4626`, `FixedPointMathLib`, and `WeightedMath`. We encourage the team to constantly monitor the statuses of 3rd parties to mitigate the side effects when unexpected activities are observed.

Alleviation

The team acknowledged this issue and they will leave it as it is for now.

SBV-03 | Potential Incorrect Index Of The Asset Token

Category	Severity	Location	Status
Logical Issue	Minor	implementations/SwellBalancerVault.sol: 53~59, 89~96	Acknowledged

Description

Even if the condition `if (address(tokens[i]) == address(asset))` is not satisfied, the variable `assetIndex`/`exitTokenIndex` still can get the default value of 0 index for the asset token.

Recommendation

We recommend reviewing the logic again and ensuring it is intended.

Alleviation

The team acknowledged this issue and they stated it is impossible to deposit tokens that do not belong to a pool in the balancer protocol.

SBV-04 | Different Interfaces With `rari-capital`

Category	Severity	Location	Status
Logical Issue	Minor	implementations/SwellBalancerVault.sol	Acknowledged

Description

The definition of functions `beforeWithdraw()` and `afterDeposit()` are different from interfaces of `rari-capital` with an additional parameter in commit `06c89f2c2ed18b93b6f0eb4cf0f183166af8877a`, and the parameter is not used.

Recommendation

We would like to confirm with the client if the current implementation aligns with the original project design.

We recommend reviewing the functions again and ensuring it is intended.

Alleviation

The team acknowledged this issue and they stated the additional function parameters are there because the UniV3 vault uses them.

SBV-05 | Unlocked Compiler Version

Category	Severity	Location	Status
Language Specific	Informational	implementations/SwellBalancerVault.sol: 2	Resolved

Description

The contract has unlocked compiler version. An unlocked compiler version in the source code of the contract permits the user to compile it at or above a particular version. This, in turn, leads to differences in the generated bytecode between compilations due to differing compiler version numbers. This can lead to an ambiguity when debugging as compiler specific bugs may occur in the codebase that would be hard to identify over a span of multiple compiler versions rather than a specific one.

Recommendation

We advise that the compiler version is instead locked at the lowest version possible that the contract can be compiled at. For example, for version `v0.8.0` the contract should contain the following line:

```
pragma solidity 0.8.0;
```

Alleviation

The team heeded our advice and resolved this issue in commit `06c89f2c2ed18b93b6f0eb4cf0f183166af8877a`.

SBV-06 | Missing Zero Address Validation

Category	Severity	Location	Status
Coding Style	Informational	implementations/SwellBalancerVault.sol: 25	Resolved

Description

Address should be checked before assignment to make sure it is not zero addresses.

Recommendation

Consider adding a zero check.

Alleviation

The team heeded our advice and resolved this issue in commit `06c89f2c2ed18b93b6f0eb4cf0f183166af8877a`.

SBV-07 | Mathematical Verification

Category	Severity	Location	Status
Logical Issue	Informational	implementations/SwellBalancerVault.sol: 61~67	Acknowledged

Description

The protocol is using some algorithms, including the logic of the function `_calcTokenOutGivenExactBptIn()`. The mathematical verification of these algorithms is not in the scope of this audit. The function logic will be checked based on the requirement documents.

Recommendation

Alleviation

The team acknowledged this issue and they will leave it as it is for now.

Appendix

Finding Categories

Logical Issue

Logical Issue findings detail a fault in the logic of the linked code, such as an incorrect notion on how block.timestamp works.

Volatile Code

Volatile Code findings refer to segments of code that behave unexpectedly on certain edge cases that may result in a vulnerability.

Language Specific

Language Specific findings are issues that would only arise within Solidity, i.e. incorrect usage of private or delete.

Coding Style

Coding Style findings usually do not affect the generated byte-code but rather comment on how to make the codebase more legible and, as a result, easily maintainable.

Checksum Calculation Method

The "Checksum" field in the "Audit Scope" section is calculated as the SHA-256 (Secure Hash Algorithm 2 with digest size of 256 bits) digest of the content of each file hosted in the listed source repository under the specified commit.

The result is hexadecimal encoded and is the same as the output of the Linux "sha256sum" command against the target file.

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