HACKEN

SMART CONTRACT CODE REVIEW AND SECURITY ANALYSIS REPORT

Customer: Hedgey
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Document

Name	Smart Contract Code Review and Security Analysis Report for Hedgey
Approved By	Evgeniy Bezuglyi | SC Audits Department Head at Hacken OU Noah Jelich | Senior Solidity SC Auditor at Hacken OU
Type	ERC721 token
Platform	EVM
Network	Ethereum
Language	Solidity
Methods	Manual Review, Automated Review, Architecture Review
Website	https://hedgey.finance/
Timeline	21.07.2022 - 08.08.2022
Changelog	22.07.2022 - Initial Review 02.08.2022 - Second Review 08.08.2022 - Third Review

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Introduction

Hacken OÜ (Consultant) was contracted by Hedgey (Customer) to conduct a Smart Contract Code Review and Security Analysis. This report presents the findings of the security assessment of the Customer's smart contracts.

Scope

The scope of the project is smart contracts in the repository:

Initial review scope

Repository:
https://github.com/hedgey-finance/NFT_OTC_Core/
Commit:
adba240e6888adfd2358116de11e6215c9be7938
Technical Documentation:
Type: Technical description
Integration and Unit Tests: Yes
Contracts:
File: ./contracts/NonTransferrableNFT.sol
SHA3: 249ec8278c12f39c75cef7d34d6f0305bd90a5ef839d039adff50fd5b80b6760

File: ./contracts/libraries/TransferHelper.sol
SHA3: b50cfa9a8492c9888c47612e8350b9402b5cdd7cd5890eea13b855d14529409e

File: ./contracts/interfaces/IWETH.sol
SHA3: ec07545517d331eec6ccb3f7dc620b82b3fe877fec00a849ada1c03338e7bf0f

Second review scope

Repository:
https://github.com/hedgey-finance/NFT_OTC_Core/
Commit:
e6c8a05601e2546e3d0d776ce3f8b7fa5968aa37
Technical Documentation:
Type: Technical description
Integration and Unit Tests: Yes
Contracts:
File: ./contracts/interfaces/IWETH.sol
SHA3: 702a6c595a3ea5c615f3aff3008b760d6d70f4c4e23f06f3ea4329160d019ee2

File: ./contracts/libraries/TransferHelper.sol
SHA3: 6afcf1fb04f38c7900ddb41c3e8095d0dd84fb481665aaeda3a6879aba4a3f84

File: ./contracts/NonTransferrableNFT.sol
SHA3: 5c8cf96d09a5c1285b0ba1c0b3e3e2ed8fdcbd8419ba724d767c4bb9fb9a3c54

Third review scope

Repository:
https://github.com/hedgey-finance/NFT_OTC_Core/
Commit:
67055a7d4f7517f15c5c85bed67fde0982eb4c2c
Technical Documentation:
Type: Technical description
Integration and Unit Tests: Yes
Contracts:

```
File: ./contracts/interfaces/IWETH.sol
SHA3: 702a6c595a3ea5c615f3aff3008b760d6d70f4c4e23f06f3ea4329160d019ee2

File: ./contracts/libraries/TransferHelper.sol
SHA3: 6afcf1fb04f38c7900ddb41c3e8095d0dd84fb481665aaeda3a6879aba4a3f84

File: ./contracts/NonTransferrableNFT.sol
SHA3: 8da626324831ec64d48170a76befba1b297b93b3ca68cb61659c585b9384771c
```

Severity Definitions

Risk Level	Description
Critical	Critical vulnerabilities are usually straightforward to exploit and can lead to assets loss or data manipulations.
High	High-level vulnerabilities are difficult to exploit; however, they also have a significant impact on smart contract execution, e.g., public access to crucial functions.
Medium	Medium-level vulnerabilities are important to fix; however, they cannot lead to assets loss or data manipulations.
Low	Low-level vulnerabilities are mostly related to outdated, unused, etc. code snippets that cannot have a significant impact on execution.

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Executive Summary

The score measurement details can be found in the corresponding section of the methodology.

Documentation quality

The total Documentation Quality score is **5** out of **10**. A technical description is provided as the detailed comments in the code. Functional requirements are not provided.

Code quality

The total CodeQuality score is **10** out of **10**. Most of the code follows official language style guides. Unit tests were provided, some out of scope tests are failing.

Architecture quality

The architecture quality score is **10** out of **10**. The architecture is clear. The development environment was provided.

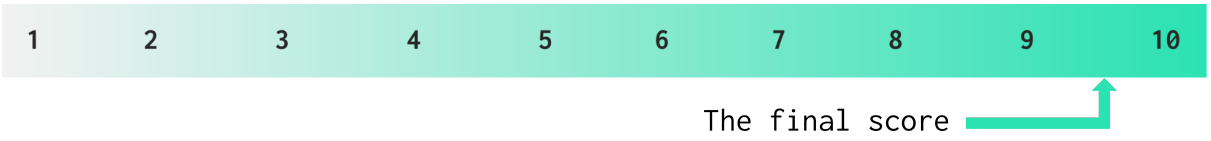
Security score

As a result of the audit, the code contains **no** issues. The security score is **10** out of **10**.

All found issues are displayed in the “Findings” section.

Summary

According to the assessment, the Customer's smart contract has the following score: **9.5**.



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Checked Items

We have audited provided smart contracts for commonly known and more specific vulnerabilities. Here are some of the items that are considered:

Item	Type	Description	Status
Default Visibility	SWC-100 SWC-108	Functions and state variables visibility should be set explicitly. Visibility levels should be specified consciously.	Passed
Integer Overflow and Underflow	SWC-101	If unchecked math is used, all math operations should be safe from overflows and underflows.	Not Relevant
Outdated Compiler Version	SWC-102	It is recommended to use a recent version of the Solidity compiler.	Passed
Floating Pragma	SWC-103	Contracts should be deployed with the same compiler version and flags that they have been tested thoroughly.	Passed
Unchecked Call Return Value	SWC-104	The return value of a message call should be checked.	Passed
Access Control & Authorization	CWE-284	Ownership takeover should not be possible. All crucial functions should be protected. Users could not affect data that belongs to other users.	Passed
SELFDESTRUCT Instruction	SWC-106	The contract should not be self-destructible while it has funds belonging to users.	Not Relevant
Check-Effect-Interaction	SWC-107	Check-Effect-Interaction pattern should be followed if the code performs ANY external call.	Passed
Assert Violation	SWC-110	Properly functioning code should never reach a failing assert statement.	Passed
Deprecated Solidity Functions	SWC-111	Deprecated built-in functions should never be used.	Passed
Delegatecall to Untrusted Callee	SWC-112	Delegatecalls should only be allowed to trusted addresses.	Not Relevant
DoS (Denial of Service)	SWC-113 SWC-128	Execution of the code should never be blocked by a specific contract state unless it is required.	Passed
Race Conditions	SWC-114	Race Conditions and Transactions Order Dependency should not be possible.	Passed
Authorization	SWC-115	tx.origin should not be used for	Passed

through tx.origin		authorization.	
Block values as a proxy for time	SWC-116	Block numbers should not be used for time calculations.	Passed
Signature Unique Id	SWC-117 SWC-121 SWC-122 EIP-155	Signed messages should always have a unique id. A transaction hash should not be used as a unique id. Chain identifier should always be used. All parameters from the signature should be used in signer recovery	Not Relevant
Shadowing State Variable	SWC-119	State variables should not be shadowed.	Passed
Weak Sources of Randomness	SWC-120	Random values should never be generated from Chain Attributes or be predictable.	Not Relevant
Incorrect Inheritance Order	SWC-125	When inheriting multiple contracts, especially if they have identical functions, a developer should carefully specify inheritance in the correct order.	Not Relevant
Calls Only to Trusted Addresses	EEA-Level-2 SWC-126	All external calls should be performed only to trusted addresses.	Passed
Presence of unused variables	SWC-131	The code should not contain unused variables if this is not justified by design.	Passed
EIP standards violation	EIP	EIP standards should not be violated.	Passed
Assets integrity	**Custom**	Funds are protected and cannot be withdrawn without proper permissions.	Passed
User Balances manipulation	**Custom**	Contract owners or any other third party should not be able to access funds belonging to users.	Passed
Data Consistency	**Custom**	Smart contract data should be consistent all over the data flow.	Passed
Flashloan Attack	**Custom**	When working with exchange rates, they should be received from a trusted source and not be vulnerable to short-term rate changes that can be achieved by using flash loans. Oracles should be used.	Not Relevant
Token Supply manipulation	**Custom**	Tokens can be minted only according to rules specified in a whitepaper or any other documentation provided by the customer.	Passed
Gas Limit and Loops	**Custom**	Transaction execution costs should not depend dramatically on the amount of	Passed

		data stored on the contract. There should not be any cases when execution fails due to the block Gas limit.	
Style guide violation	**Custom**	Style guides and best practices should be followed.	Passed
Requirements Compliance	**Custom**	The code should be compliant with the requirements provided by the Customer.	Passed
Environment Consistency	**Custom**	The project should contain a configured development environment with a comprehensive description of how to compile, build and deploy the code.	Passed
Secure Oracles Usage	**Custom**	The code should have the ability to pause specific data feeds that it relies on. This should be done to protect a contract from compromised oracles.	Not Relevant
Tests Coverage	**Custom**	The code should be covered with unit tests. Test coverage should be 100%, with both negative and positive cases covered. Usage of contracts by multiple users should be tested.	Passed
Stable Imports	**Custom**	The code should not reference draft contracts, that may be changed in the future.	Passed

System Overview

NonTransferrableNFTs is an ERC-721 project with the following contracts:

- *NonTransferrableNFTs* — is a non-transferrable ERC-721 token.
  It has the following attributes:
  - Name: NonTransferrable Hedgeys
  - Symbol: NTHG

  The contract allows to lock any tokens in any amount (> 0) for any amount of time. When locking, the NFT is minted to the defined by the user holder address. When lock time expires, it is possible to redeem the tokens: the NFT is burnt, and the locked tokens are transferred to the holder address.
- *TransferHelper* — is a library that helps to transfer tokens and coins, used in *NonTransferrableNFTs* contract.
- *IWETH* — is an interface for handling ETH wrapping into WETH and unwrapping WETH into ETHm used in *TransferHelper* library.

Risks

- *NonTransferrableNFTs* token can not be transferred.

Findings

■■■■ Critical

No critical severity issues were found.

■■■ High

1. **Funds lock**

   The contract accepts the native coins (*receive* function), but there is no possibility to withdraw them.

   Funds can be locked in the contract.

   File: ./contracts/NonTransferrableNFT.sol

   Contract: NonTransferrableNFT

   Function: receive

   Recommendation: Add the function for native coins withdrawal.

   Status: Fixed (Revised commit: e6c8a05601e2546e3d0d776ce3f8b7fa5968aa37)

2. **Access control violation**

   The *updateBaseURI* function is not protected, and is callable by anyone.

   Therefore, any user can update the base URI value (once).

   File: ./contracts/NonTransferrableNFT.sol

   Contract: NonTransferrableNFT

   Function: updateBaseURI

   Recommendation: Ensure that the *updateBaseURI* function is callable only by the admin user.

   Status: Fixed (Revised commit: e6c8a05601e2546e3d0d776ce3f8b7fa5968aa37)

3. **Requirements violation**

   According to the comment in code, the locked WETH should be unwrapped and delivered in ETH during the redemption. (“*handles weth in case WETH is being held - this allows us to unwrap and deliver ETH upon redemption of a timelocked NFT with ETH*”)

   However, the WETH is not unwrapped and is delivered in WETH during the redemption.

   File: ./contracts/NonTransferrableNFT.sol

   Contract: NonTransferrableNFT

Function: _redeemNFT

Recommendation: Implement the code according to requirements.

Status: Fixed (Revised commit: 67055a7d4f7517f15c5c85bed67fde0982eb4c2c)

Medium

Failing tests

The *Cannot Transfer: wallet cannot transfer a non-transferrable NFT* test is failing.

Recommendation: Ensure that all the test cases are passing.

Status: Fixed (Revised commit: e6c8a05601e2546e3d0d776ce3f8b7fa5968aa37). Out of scope: 19 other project tests fail; it is recommended to ensure that all the project tests are passing.

Low

1. **Block values as a proxy for time using**

   The contract uses *block.timestamp* for time calculations. It is not precise and safe.

   File: ./contracts/NonTransferrableNFT.sol

   Contract: NonTransferrableNFT

   Functions: createNFT, _redeemNFT

   Recommendation: It is recommended to avoid using *block.timestamp* in the time calculations. Alternatively, it is safe to use oracles.

   Status: Mitigated. The Customer comment: “per the blogs block time will be consistent at 12 seconds post merge, and since the usage for us is only that events can happen after a certain block.timestamp, we feel this is as good or better than a centralized oracle like chainlink (and significantly less expensive)”.

2. **Floating pragma**

   Contracts with unlocked pragmas may be deployed by the latest compiler, which may have higher risks of undiscovered bugs.

   Files: ./contracts/libraries/TransferHelper.sol, ./contracts/interfaces/IWETH.sol

   Recommendation: Consider locking the pragma version whenever possible.

   Status: Fixed (Revised commit: e6c8a05601e2546e3d0d776ce3f8b7fa5968aa37)

Disclaimers

Hacken Disclaimer

The smart contracts given for audit have been analyzed by the best industry practices at the date of this report, with cybersecurity vulnerabilities and issues in smart contract source code, the details of which are disclosed in this report (Source Code); the Source Code compilation, deployment, and functionality (performing the intended functions).

The report contains no statements or warranties on the identification of all vulnerabilities and security of the code. The report covers the code submitted to and reviewed, so it may not be relevant after any modifications. Do not consider this report as a final and sufficient assessment regarding the utility and safety of the code, bug-free status, or any other contract statements.

While we have done our best in conducting the analysis and producing this report, it is important to note that you should not rely on this report only — we recommend proceeding with several independent audits and a public bug bounty program to ensure the security of smart contracts.

English is the original language of the report. The Consultant is not responsible for the correctness of the translated versions.

Technical Disclaimer

Smart contracts are deployed and executed on a blockchain platform. The platform, its programming language, and other software related to the smart contract can have vulnerabilities that can lead to hacks. Thus, Consultant cannot guarantee the explicit security of the audited smart contracts.