PALADIN
BLOCKCHAIN SECURITY

Smart Contract Security Assessment

Final Report

For Maximum Farm

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The audit report has made all reasonable attempts to provide clear and articulate recommendations to the Project team with respect to the rectification, amendment and/or revision of any highlighted issues, vulnerabilities or exploits within the contracts provided. It is the sole responsibility of the Project team to sufficiently test and perform checks, ensuring that the contracts are functioning as intended, specifically that the functions therein contained within said contracts have the desired intended effects, functionalities and outcomes of the Project team.

1 Overview

This report has been prepared for Maximum Farm on the Fantom Opera network. Paladin provides a user-centred examination of the smart contracts to look for vulnerabilities, logic errors or other issues from both an internal and external perspective.

1.1 Summary

Project Name	Maximum Farm
URL	https://maximum.farm/
Platform	Fantom Opera
Language	Solidity

1.2 Contracts Assessed

Name	Contract	Live Code Match
`Maximum`	`0x287A3f943Db1C053c3e79d2f211FFE5c795b978B`	MATCH
`MasterChef`	`0xb9ac3a4c1b76b38fb7a374b4d0e4809d08ef092e`	MATCH

1.3 Findings Summary

Severity	Found	Resolved	Partially Resolved	Acknowledged (no change made)
High	0	-	-	-
Medium	0	-	-	-
Low	2	-	-	2
Informational	4	-		4
Total	**6**	**-**	**-**	**6**

Classification of Issues

Severity	Description
High	Exploits, vulnerabilities or errors that will certainly or probabilistically lead towards loss of funds, control, or impairment of the contract and its functions. Issues under this classification are recommended to be fixed with utmost urgency.
Medium	Bugs or issues with that may be subject to exploit, though their impact is somewhat limited. Issues under this classification are recommended to be fixed as soon as possible.
Low	Effects are minimal in isolation and do not pose a significant danger to the project or its users. Issues under this classification are recommended to be fixed nonetheless.
Informational	Consistency, syntax or style best practices. Generally pose a negligible level of risk, if any.

1.3.1 Maximum

ID	Severity	Summary	Status
01	INFO	`_totalSupply` is sufficient to keep track of the total token supply minted	ACKNOWLEDGED
02	INFO	Lack of events for initializeMC	ACKNOWLEDGED

1.3.2 MasterChef

ID	Severity	Summary	Status
03	LOW	Rewards are calculated based on block number instead of timestamp	ACKNOWLEDGED
04	INFO	`MAX_EMISSION_RATE` can be declared as a constant	ACKNOWLEDGED
05	INFO	Total token supply might not be minted due to try-catch pattern	ACKNOWLEDGED
06	INFO	The Masterchef contains token source code different from the token that is actually deployed	ACKNOWLEDGED
07	INFO	Deposit uses raw subtraction instead of SafeMath for the before-after pattern	ACKNOWLEDGED
08	INFO	Typographical errors	ACKNOWLEDGED

2 Findings

2.1 Maximum

The Maximum token contract allows for Max tokens to be minted when the `mint` function is called by the MasterChef contract, which at the time of deployment would not yet be set, but can be set once through `initializeMC`. In case this is set to an EOA, further minting can be done by the owner. Users should therefore carefully inspect that the owner of this contract has been correctly initialized to be the Masterchef.

There is a maximum supply of 50,000 tokens, and 30,000 tokens are pre-minted to the owner.

2.1.1 Token Overview

Address	0x287a3f943db1c053c3e79d2f211ffe5c795b978b
Token Supply	50,000
Decimal Places	18
Transfer Max Size	No maximum
Transfer Min Size	No minimum
Transfer Fees	None
Pre-mints	30,000

2.1.2 Privileged Roles

The following functions can be called by the owner of the contract:

- `mint`
- `initializeMC`
- `transferOwnership`
- `renounceOwnership`

2.1.3 Issues & Recommendations

Issue #01	**`_totalSupply` is sufficient to keep track of the total token supply minted**
Severity	INFORMATIONAL
Description	Both `MAXCAP` and `_totalSupply` are incremented by the amount of tokens minted, and decremented by the amount of tokens burnt. This makes `MAXCAP` redundant.
Recommendation	Consider removing `MAXCAP` and keeping track of the token supply using `_totalSupply`. If the emissions should stop when the `MAXCAP` is minted (eg. on burns, new emissions should not be possible again), consider removing the `MAXCAP` reduction on burn.
Resolution	ACKNOWLEDGED

Issue #02	**Lack of events for `initializeMC`**
Severity	INFORMATIONAL
Description	Important functions that change the core state of the contract should emit events for third parties to be able to listen to.
Recommendation	Consider adding events for the function.
Resolution	ACKNOWLEDGED

2.2 MasterChef

TheMasterChef is a fork of Goose Finance's Masterchef. A notable feature of forking this Masterchef is the removal of the `migrator` function from the original Pancakeswap, which as of late has been used maliciously to steal user's tokens. Additionally, in comparison to Goose Finance, Maximum Farm has limited the deposit fee to at most 4%. We commend Maximum Farm on their decision to fork a relatively safer version of the Masterchef and trim down the governance privileges with regards to the deposit fees.

2.2.1 Privileged Roles

The following functions can be called by the owner of the Masterchef:

- `add`
- `set`
- `setDevAddress`
- `setFeeAddress`
- `updateEmissionRate`
- `updateStartBlock`
- `transferOwnership`
- `renounceOwnership`

2.2.2 Issues & Recommendations

Issue #03	**Rewards are calculated based on block number instead of timestamp**
Severity	LOW SEVERITY
Description	As rewards are calculated using `block.number` instead of `block.timestamp`, and block intervals are not always consistent on Fantom, it might be possible to accelerate the rewards beyond the expected emission rate by having blocks produced at a faster rate. This is a known issue for EVM-based chains such as Avalanche and Fantom. At the point of this review, it was observed that the average block time was 1 second.
Recommendation	Consider switching from calculation of rewards per block to rewards per second.
Resolution	ACKNOWLEDGED

Issue #04	**`MAX_EMISSION_RATE` can be declared as a `constant`**
Severity	INFORMATIONAL
Description	As `MAX_EMISSION_RATE` is only declared once as a state variable and never changed, it can be declared as a constant for gas optimization.
Recommendation	Add the `constant` keyword when declaring `MAX_EMISSION_RATE`.
Resolution	ACKNOWLEDGED

Issue #05	Total token supply might not be minted due to try-catch pattern
Severity	INFORMATIONAL

Description	As there is a MAXCAPSUPPLY for the Salem token, minting the reward and causing the maximum cap to exceed would result in a revert.
	
	`require(MAXCAP.add(amount) <= MAXCAPSUPPLY, "Max supply reached");`
	
	To prevent this, the following try and catch pattern is done in `updatePool`.
	
	Line 1166 onwards
	`try token.mint(devaddr, MaxReward.div(10)) {`
	`} catch (bytes memory reason) {`
	`  MaxReward = 0;`
	`  emit MaxMintError(reason);`
	`}`
	
	`try token.mint(address(this), MaxReward) {`
	`} catch (bytes memory reason) {`
	`  MaxReward = 0;`
	`  emit MaxMintError(reason);`
	`}`
	
	In the case where `MAXCAP + amount` does exceed `MAXCAPSUPPLY`, the mint will not be done. This means that the token supply could be capped at an amount slightly lower than `MAXCAPSUPPLY`.

Recommendation	Consider minting the difference between `MAXCAPSUPPLY` and `MAXCAP`, if any.
Resolution	ACKNOWLEDGED

Issue #06	**The Masterchef contains token source code different from the token that is actually deployed**
Severity	INFORMATIONAL
Description	The Masterchef contains faulty Maximum token source code, but the relevant error has been fixed in the actual deployed token. This might however still mislead third-party reviewers that only inspect the Masterchef source code.
Recommendation	Consider removing the Maximum source code as to not confuse third-party reviewers.
Resolution	ACKNOWLEDGED

Issue #07	Deposit uses raw subtraction instead of SafeMath for the before-after pattern
Severity	INFORMATIONAL

Location	Lines 1194–1196
	`uint256 balanceBefore = pool.lpToken.balanceOf(address(this));`
	`pool.lpToken.safeTransferFrom(address(msg.sender), address(this), _amount);`
	`_amount = pool.lpToken.balanceOf(address(this)) - balanceBefore;`

Description	The `deposit` function uses raw subtraction which could theoretically underflow since the contract is compiled on a Solidity version lower than 0.8.0. If a token which has special transfer logic that decreases the receivers' balance is added, the Masterchef can be drained of such token due to the underflow.
Recommendation	Consider using SafeMath instead: `_amount = pool.lpToken.balanceOf(address(this)).sub(balanceBefore);`
Resolution	ACKNOWLEDGED

Issue #08	Typographical errors
Severity	INFORMATIONAL
Description	The Masterchef still contains references to "Alpha" instead of the "Maximum" token.
Recommendation	Consider fixing the typographical errors.
Resolution	ACKNOWLEDGED

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