IBULLSWAP

Smart Contract Review

Deliverable: Smart Contract Audit Report

Security Report

December 2021

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Report Summary

Title	**IBULLSWAP Smart Contract Audit**		
Project Owner	IBULLSWAP		
Type	Public		
Reviewed by	Vatsal Raychura	**Revision date**	30/12/2021
Approved by	eNebula Solutions Private Limited	**Approval date**	30/12/2021
		Nº Pages	**29**

Overview

Background

IBULLSWAP requested that eNebula Solutions perform an Extensive Smart Contract audit of their MasterChef Smart Contract.

Project Dates

The following is the project schedule for this review and report:

- **December 30**: Smart Contract Review Completed *(Completed)*
- **December 30**: Delivery of Smart Contract Audit Report *(Completed)*

Review Team

The following eNebula Solutions team member participated in this review:

- Sejal Barad, Security Researcher and Engineer
- Vatsal Raychura, Security Researcher and Engineer

Coverage

Target Specification and Revision

For this audit, we performed research, investigation, and review of the smart contract of IBULLSWAP.

The following documentation repositories were considered in-scope for the review:

- IBULLSWAP Project: https://bscscan.com/address/0x2C6d58a9166E0AA7c3b5850774eCb01C152eB5b9#code

Introduction

Given the opportunity to review IBULLSWAP Project's smart contract source code, we in the report outline our systematic approach to evaluate potential security issues in the smart contract implementation, expose possible semantic inconsistencies between smart contract code and design document, and provide additional suggestions or recommendations for improvement. Our results show that the given version of smart contracts is ready to launch after resolving the mentioned issues, there are no critical or high issues found related to business logic, security or performance.

About IBULLSWAP: -

Item	Description
Issuer	IBULLSWAP
Website	https://www.ibullswap.finance/
Platform	Solidity
Audit Method	Whitebox
Latest Audit Report	December 30, 2021

The Test Method Information: -

Test method	Description
Black box testing	Conduct security tests from an attacker's perspective externally.
Grey box testing	Conduct security testing on code modules through the scripting tool, observing the internal running status, mining weaknesses.
White box testing	Based on the open-source code, non-open-source code, to detect whether there are vulnerabilities in programs such as nodes, SDK, etc.

The vulnerability severity level information:

Level	Description
Critical	Critical severity vulnerabilities will have a significant effect on the security of the DeFi project, and it is strongly recommended to fix the critical vulnerabilities.
High	High severity vulnerabilities will affect the normal operation of the DeFi project. It is strongly recommended to fix high-risk vulnerabilities.
Medium	Medium severity vulnerability will affect the operation of the DeFi project. It is recommended to fix medium-risk vulnerabilities.
Low	Low severity vulnerabilities may affect the operation of the DeFi project in certain scenarios. It is suggested that the project party should evaluate and consider whether these vulnerabilities need to be fixed.
Weakness	There are safety risks theoretically, but it is extremely difficult to reproduce in engineering.

The Full List of Check Items:

Category	Check Item
Basic Coding Bugs	Constructor Mismatch
	Ownership Takeover
	Redundant Fallback Function
	Overflows & Underflows
	Reentrancy
	MONEY-Giving Bug
	Blackhole
	Unauthorized Self-Destruct
	Revert DoS
	Unchecked External Call
	Gasless Send
	Send Instead of Transfer
	Costly Loop
	(Unsafe) Use of Untrusted Libraries
	(Unsafe) Use of Predictable Variables
	Transaction Ordering Dependence
	Deprecated Uses
Semantic Consistency Checks	Semantic Consistency Checks
	Business Logics Review

Advanced DeFi Scrutiny	Functionality Checks
	Authentication Management
	Access Control & Authorization
	Oracle Security
	Digital Asset Escrow
	Kill-Switch Mechanism
	Operation Trails & Event Generation
	ERC20 Idiosyncrasies Handling
	Frontend-Contract Integration
	Deployment Consistency
	Holistic Risk Management
Additional Recommendations	Avoiding Use of Variadic Byte Array
	Using Fixed Compiler Version
	Making Visibility Level Explicit
	Making Type Inference Explicit
	Adhering To Function Declaration Strictly
	Following Other Best Practices

Common Weakness Enumeration (CWE) Classifications Used in This Audit:

Category	Summary
Configuration	Weaknesses in this category are typically introduced during the configuration of the software.
Data Processing Issues	Weaknesses in this category are typically found in functionality that processes data.
Numeric Errors	Weaknesses in this category are related to improper calculation or conversion of numbers.
Security Features	Weaknesses in this category are concerned with topics like authentication, access control, confidentiality, cryptography, and privilege management. (Software security is not security software.)
Time and State	Weaknesses in this category are related to the improper management of time and state in an environment that supports simultaneous or near-simultaneous computation by multiple systems, processes, or threads.
Error Conditions, Return Values, Status Codes	Weaknesses in this category include weaknesses that occur if a function does not generate the correct return/status code, or if the application does not handle all possible return/status codes that could be generated by a function.
Resource Management	Weaknesses in this category are related to improper management of system resources.

Behavioral Issues	Weaknesses in this category are related to unexpected behaviors from code that an application uses.
Business Logics	Weaknesses in this category identify some of the underlying problems that commonly allow attackers to manipulate the business logic of an application. Errors in business logic can be devastating to an entire application.
Initialization and Cleanup	Weaknesses in this category occur in behaviors that are used for initialization and breakdown.
Arguments and Parameters	Weaknesses in this category are related to improper use arguments or parameters within function calls.
Expression Issues	Weaknesses in this category are related to incorrectly written expressions within code.
Coding Practices	Weaknesses in this category are related to coding practices that are deemed unsafe and increase the chances that an ex pilotable vulnerability will be present in the application. They may not directly introduce a vulnerability, but indicate the product has not been carefully developed or maintained.

Findings

Summary

Here is a summary of our findings after analyzing the IBULLSWAP's Smart Contract. During the first phase of our audit, we studied the smart contract source code and ran our in-house static code analyzer through the Specific tool. The purpose here is to statically identify known coding bugs, and then manually verify (reject or confirm) issues reported by tool. We further manually review business logics, examine system operations, and place DeFi-related aspects under scrutiny to uncover possible pitfalls and/or bugs.

Severity	No. of Issues
Critical	0
High	0
Medium	0
Low	3
Total	3

We have so far identified that there are potential issues with severity of **0 Critical, 0 High, 0 Medium, and 3 Low**. Overall, these smart contracts are well- designed and engineered.

Functional Overview

($) = payable function # = non-constant function	[Pub] public [Ext] external [Prv] private [Int] internal

+ [Int] IBEP20
  - [Ext] totalSupply
  - [Ext] decimals
  - [Ext] symbol
  - [Ext] name
  - [Ext] getOwner
  - [Ext] balanceOf
  - [Ext] transfer #
  - [Ext] allowance
  - [Ext] approve #
  - [Ext] transferFrom #

+ [Lib] SafeMath
  - [Int] tryAdd
  - [Int] trySub
  - [Int] tryMul
  - [Int] tryDiv
  - [Int] tryMod
  - [Int] add
  - [Int] sub
  - [Int] mul
  - [Int] div

- [Int] mod
- [Int] sub
- [Int] div
- [Int] mod

+ [Lib] Address
- [Int] isContract
- [Int] sendValue #
- [Int] functionCall #
- [Int] functionCall #
- [Int] functionCallWithValue #
- [Int] functionCallWithValue #
- [Int] functionStaticCall
- [Int] functionStaticCall
- [Int] functionDelegateCall #
- [Int] functionDelegateCall #
- [Prv] _verifyCallResult

+ [Lib] SafeBEP20
- [Int] safeTransfer #
- [Int] safeTransferFrom #
- [Int] safeApprove #
- [Int] safeIncreaseAllowance #
- [Int] safeDecreaseAllowance #
- [Prv] _callOptionalReturn #

+ [Int] IIBullSwapReferral
- [Ext] recordReferral #
- [Ext] recordReferralCommission #
- [Ext] getReferrer

+ Context
  - [Int] _msgSender
  - [Int] _msgData

+ Ownable (Context)
  - [Int] <Constructor> #
  - [Pub] owner
  - [Pub] renounceOwnership #
    - modifiers: onlyOwner
  - [Pub] transferOwnership #
    - modifiers: onlyOwner

+ ReentrancyGuard
  - [Pub] <Constructor> #

+ BEP20 (Context, IBEP20, Ownable)
  - [Pub] <Constructor> #
  - [Ext] getOwner
  - [Pub] name
  - [Pub] decimals
  - [Pub] symbol
  - [Pub] totalSupply
  - [Pub] balanceOf
  - [Pub] transfer #
  - [Pub] allowance
  - [Pub] approve #
  - [Pub] transferFrom #
  - [Pub] increaseAllowance #
  - [Pub] decreaseAllowance #
  - [Pub] mint #
    - modifiers: onlyOwner

- [Int] _transfer #
- [Int] _mint #
- [Int] _burn #
- [Int] _approve #
- [Int] _burnFrom #

+ IBullSwap (BEP20)
- [Pub] <Constructor> #
- [Pub] mint #
  - modifiers: onlyOwner
- [Ext] delegates
- [Ext] delegate #
- [Ext] delegateBySig #
- [Ext] getCurrentVotes
- [Ext] getPriorVotes
- [Int] _delegate #
- [Int] _moveDelegates #
- [Int] _writeCheckpoint #
- [Int] safe32
- [Int] getChainId

+ MasterChef (Ownable, ReentrancyGuard)
- [Pub] <Constructor> #
- [Ext] poolLength
- [Pub] add #
  - modifiers: onlyOwner
- [Pub] set #
  - modifiers: onlyOwner
- [Pub] getMultiplier
- [Ext] pendingIbull
- [Pub] canHarvest

- [Pub] massUpdatePools #
- [Pub] updatePool #
- [Pub] deposit #
  - modifiers: nonReentrant
- [Pub] withdraw #
  - modifiers: nonReentrant
- [Pub] emergencyWithdraw #
  - modifiers: nonReentrant
- [Int] payOrLockupPendingIbull #
- [Pub] approve #
  - modifiers: onlyOwner
- [Int] safeIbullTransfer #
- [Pub] setDevAddress #
- [Pub] setFeeAddress #
- [Pub] updateEmissionRate #
  - modifiers: onlyOwner
- [Pub] setIbullReferral #
  - modifiers: onlyOwner
- [Pub] setReferralCommissionRate #
  - modifiers: onlyOwner
- [Int] payReferralCommission #

Detailed Results

Issues Checking Status

1. Floating Pragma

- SWC ID:103
- Severity: Low
- Location: MasterChef.sol
- Relationships: CWE-664: Improper Control of a Resource Through its Lifetime
- Description: A floating pragma is set. The current pragma Solidity directive is ""^0.4.0"". It is recommended to specify a fixed compiler version to ensure that the bytecode produced does not vary between builds. This is especially important if you rely on bytecode-level verification of the code.

```
4
5   //SPDX-License-Identifier: None
6   pragma solidity >=0.4.0;
7
```

- Remediations: Lock the pragma version and also consider known bugs (https://github.com/ethereum/solidity/releases) for the compiler version that is chosen.

2. **Block values as a proxy for time**

- SWC ID:116
- Severity: Low
- Location: MasterChef.sol
- Relationships: CWE-829: Inclusion of Functionality from Untrusted Control Sphere
- Description: A control flow decision is made based on The block.timestamp environment variable. The block.timestamp environment variable is used to determine a control flow decision. Note that the values of variables like coinbase, gaslimit, block number and timestamp are predictable and can be manipulated by a malicious miner. Also keep in mind that attackers know hashes of earlier blocks. Don't use any of those environment variables as sources of randomness and be aware that use of these variables introduces a certain level of trust into miners.

```
675         address signatory = ecrecover(digest, v, r, s);
676         require(signatory != address(0), "IBULL::delegateBySig: invalid signature");
677         require(nonce == nonces[signatory]++, "IBULL::delegateBySig: invalid nonce");
678         require(now <= expiry, "IBULL::delegateBySig: signature expired");
679         return _delegate(signatory, delegatee);
```

- Remediations: Developers should write smart contracts with the notion that block values are not precise, and the use of them can lead to unexpected effects. Alternatively, they may make use oracles.

3. Weak Sources of Randomness from Chain Attributes

- SWC ID:120
- Severity: Low
- Location: MasterChef.sol
- Relationships: CWE-330: Use of Insufficiently Random Values
- Description: Potential use of "block.number" as source of randonmness. The environment variable "block.number" looks like it might be used as a source of randomness. Note that the values of variables like coinbase, gaslimit, block number and timestamp are predictable and can be manipulated by a malicious miner. Also keep in mind that attackers know hashes of earlier blocks. Don't use any of those environment variables as sources of randomness and be aware that use of these variables introduces a certain level of trust into miners.

```
708         require(blockNumber < block.number, "IBULL::getPriorVotes: not yet determined");
781       uint32 blockNumber = safe32(block.number, "IBULL::_writeCheckpoint: block number exceeds 32 bits");
793     function safe32(uint n, string memory errorMessage) internal pure returns (uint32) {
794         require(n < 2**32, errorMessage);
795         return uint32(n);
902         uint256 lastRewardBlock = block.number > startBlock ? block.number : startBlock;
938       if (block.number > pool.lastRewardBlock && lpSupply != 0) {
939           uint256 multiplier = getMultiplier(pool.lastRewardBlock, block.number);
940           uint256 ibullReward = multiplier.mul(ibullPerBlock).mul(pool.allocPoint).div(totalAllocPoint);
941           accIbullPerShare = accIbullPerShare.add(ibullReward.mul(1e12).div(lpSupply));
942       }
962     function updatePool(uint256 _pid) public {
963         PoolInfo storage pool = poolInfo[_pid];
964         if (block.number <= pool.lastRewardBlock) {
965             return;
966         }
967         uint256 lpSupply = pool.lpToken.balanceOf(address(this));
968         if (lpSupply == 0 || pool.allocPoint == 0) {
969             pool.lastRewardBlock = block.number;
970             return;
971         }
972         uint256 multiplier = getMultiplier(pool.lastRewardBlock, block.number);
973         uint256 ibullReward = multiplier.mul(ibullPerBlock).mul(pool.allocPoint).div(totalAllocPoint);
974         ibull.mint(devAddress, ibullReward.div(10));
975         ibull.mint(address(this), ibullReward);
976         pool.accIbullPerShare = pool.accIbullPerShare.add(ibullReward.mul(1e12).div(lpSupply));
977         pool.lastRewardBlock = block.number;
978     }
```

- Remediations:
  - Using commitment scheme, e.g. RANDAO.
  - Using external sources of randomness via oracles, e.g. Oraclize. Note that this approach requires trusting in oracle, thus it may be reasonable to use multiple oracles.
  - Using Bitcoin block hashes, as they are more expensive to mine.

Automated Tools Results

Slither: -

```
Reentrancy in MasterChef.updateEmissionRate(uint256) (MasterChef_New.sol#1093-1097):
        External calls:
        - massUpdatePools() (MasterChef_New.sol#1094)
                - tbull.mint(devAddress,tbullReward.div(10)) (MasterChef_New.sol#974)
                - tbull.mint(address(this),tbullReward) (MasterChef_New.sol#975)
        State variables written after the call(s):
        - tbullPerBlock = _tbullPerBlock (MasterChef_New.sol#1096)
Reentrancy in MasterChef.updatePool(uint256) (MasterChef_New.sol#962-978):
        External calls:
        - tbull.mint(devAddress,tbullReward.div(10)) (MasterChef_New.sol#974)
        - tbull.mint(address(this),tbullReward) (MasterChef_New.sol#975)
        State variables written after the call(s):
        - pool.accIbullPerShare = pool.accIbullPerShare.add(tbullReward.mul(1e12).div(lpSupply)) (MasterChef_New.sol#976)
        - pool.lastRewardBlock = block.number (MasterChef_New.sol#977)
Reentrancy in MasterChef.withdraw(uint256,uint256) (MasterChef_New.sol#1007-1019):
        External calls:
        - updatePool(_pid) (MasterChef_New.sol#1011)
                - tbull.mint(devAddress,tbullReward.div(10)) (MasterChef_New.sol#974)
                - tbull.mint(address(this),tbullReward) (MasterChef_New.sol#975)
        - payOrLockupPendingIbull(_pid) (MasterChef_New.sol#1012)
                - tbull.transfer(_to,tbullBal) (MasterChef_New.sol#1073)
                - tbull.transfer(_to,_amount) (MasterChef_New.sol#1075)
                - tbull.mint(referrer,commissionAmount) (MasterChef_New.sol#1117)
                - tbullReferral.recordReferralCommission(referrer,commissionAmount) (MasterChef_New.sol#1118)
        State variables written after the call(s):
        - payOrLockupPendingIbull(_pid) (MasterChef_New.sol#1012)
                - user.nextHarvestUntil = block.timestamp.add(pool.harvestInterval) (MasterChef_New.sol#1040)
                - user.rewardLockedUp = 0 (MasterChef_New.sol#1050)
                - user.nextHarvestUntil = block.timestamp.add(pool.harvestInterval) (MasterChef_New.sol#1051)
                - user.rewardLockedUp = user.rewardLockedUp.add(pending) (MasterChef_New.sol#1058)
        - user.amount = user.amount.sub(_amount) (MasterChef_New.sol#1014)
Reentrancy in MasterChef.withdraw(uint256,uint256) (MasterChef_New.sol#1007-1019):
        External calls:
        - updatePool(_pid) (MasterChef_New.sol#1011)
                - tbull.mint(devAddress,tbullReward.div(10)) (MasterChef_New.sol#974)
                - tbull.mint(address(this),tbullReward) (MasterChef_New.sol#975)
        - payOrLockupPendingIbull(_pid) (MasterChef_New.sol#1012)
                - tbull.transfer(_to,tbullBal) (MasterChef_New.sol#1073)
                - tbull.transfer(_to,_amount) (MasterChef_New.sol#1075)
                - tbull.mint(referrer,commissionAmount) (MasterChef_New.sol#1117)
                - tbullReferral.recordReferralCommission(referrer,commissionAmount) (MasterChef_New.sol#1118)
        - pool.lpToken.safeTransfer(address(msg.sender),_amount) (MasterChef_New.sol#1015)
        State variables written after the call(s):
        - user.rewardDebt = user.amount.mul(pool.accIbullPerShare).div(1e12) (MasterChef_New.sol#1017)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#reentrancy-vulnerabilities-1

MasterChef.approve(address,address,uint256) (MasterChef_New.sol#1064-1067) ignores return value by IBEP20(tokenAddress).approve(spender,amount) (Maste
rChef_New.sol#1065)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#unused-return

BEP20.constructor(string,string).name (MasterChef_New.sol#300) shadows:
        - BEP20.name() (MasterChef_New.sol#316-318) (function)
        - IBEP20.name() (MasterChef_New.sol#13) (function)
BEP20.constructor(string,string).symbol (MasterChef_New.sol#300) shadows:
        - BEP20.symbol() (MasterChef_New.sol#330-332) (function)
        - IBEP20.symbol() (MasterChef_New.sol#12) (function)
BEP20.allowance(address,address).owner (MasterChef_New.sol#364) shadows:
        - Ownable.owner() (MasterChef_New.sol#239-241) (function)
BEP20._approve(address,address,uint256).owner (MasterChef_New.sol#541) shadows:
        - Ownable.owner() (MasterChef_New.sol#239-241) (function)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#local-variable-shadowing

MasterChef.add(uint256,IBEP20,uint16,uint256,bool) (MasterChef_New.sol#896-912) should emit an event for:
        - totalAllocPoint = totalAllocPoint.add(_allocPoint) (MasterChef_New.sol#903)
MasterChef.set(uint256,uint256,uint16,uint256,bool) (MasterChef_New.sol#915-925) should emit an event for:
        - totalAllocPoint = totalAllocPoint.sub(poolInfo[_pid].allocPoint).add(_allocPoint) (MasterChef_New.sol#921)
MasterChef.setReferralCommissionRate(uint16) (MasterChef_New.sol#1105-1108) should emit an event for:
        - referralCommissionRate = _referralCommissionRate (MasterChef_New.sol#1107)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#missing-events-arithmetic

Reentrancy in MasterChef.deposit(uint256,uint256,address) (MasterChef_New.sol#981-1004):
        External calls:
        - updatePool(_pid) (MasterChef_New.sol#984)
                - tbull.mint(devAddress,tbullReward.div(10)) (MasterChef_New.sol#974)
                - tbull.mint(address(this),tbullReward) (MasterChef_New.sol#975)
        - tbullReferral.recordReferral(msg.sender,_referrer) (MasterChef_New.sol#986)
        - payOrLockupPendingIbull(_pid) (MasterChef_New.sol#988)
                - tbull.transfer(_to,tbullBal) (MasterChef_New.sol#1073)
                - tbull.transfer(_to,_amount) (MasterChef_New.sol#1075)
                - tbull.mint(referrer,commissionAmount) (MasterChef_New.sol#1117)
                - tbullReferral.recordReferralCommission(referrer,commissionAmount) (MasterChef_New.sol#1118)
        Event emitted after the call(s):
        - ReferralCommissionPaid(_user,referrer,commissionAmount) (MasterChef_New.sol#1119)
                - payOrLockupPendingIbull(_pid) (MasterChef_New.sol#988)
        - RewardLockedUp(msg.sender,_pid,pending) (MasterChef_New.sol#1060)
                - payOrLockupPendingIbull(_pid) (MasterChef_New.sol#988)
```

Smart Contract Audit

```
Reentrancy in MasterChef.deposit(uint256,uint256,address) (MasterChef_New.sol#981-1004):
        External calls:
        - updatePool(_pid) (MasterChef_New.sol#984)
                - tbull.mint(devAddress,tbullReward.div(10)) (MasterChef_New.sol#974)
                - tbull.mint(address(this),tbullReward) (MasterChef_New.sol#975)
        - tbullReferral.recordReferral(msg.sender,_referrer) (MasterChef_New.sol#988)
        - payOrLockupPendingIbull(_pid) (MasterChef_New.sol#988)
                - tbull.transfer(_to,tbullBal) (MasterChef_New.sol#1073)
                - tbull.transfer(_to,_amount) (MasterChef_New.sol#1075)
                - tbull.mint(referrer,commissionAmount) (MasterChef_New.sol#1117)
                - tbullReferral.recordReferralCommission(referrer,commissionAmount) (MasterChef_New.sol#1118)
        - pool.lpToken.safeTransferFrom(address(msg.sender),address(this),_amount) (MasterChef_New.sol#991)
        - pool.lpToken.safeTransfer(feeAddress,depositFee) (MasterChef_New.sol#996)
        Event emitted after the call(s):
        - Deposit(msg.sender,_pid,_amount) (MasterChef_New.sol#1003)
Reentrancy in MasterChef.emergencyWithdraw(uint256) (MasterChef_New.sol#1022-1032):
        External calls:
        - pool.lpToken.safeTransfer(address(msg.sender),amount) (MasterChef_New.sol#1030)
        Event emitted after the call(s):
        - EmergencyWithdraw(msg.sender,_pid,amount) (MasterChef_New.sol#1031)
Reentrancy in MasterChef.payOrLockupPendingIbull(uint256) (MasterChef_New.sol#1035-1062):
        External calls:
        - safeIbullTransfer(msg.sender,totalRewards) (MasterChef_New.sol#1054)
                - tbull.transfer(_to,tbullBal) (MasterChef_New.sol#1073)
                - tbull.transfer(_to,_amount) (MasterChef_New.sol#1075)
        - payReferralCommission(msg.sender,totalRewards) (MasterChef_New.sol#1055)
                - tbull.mint(referrer,commissionAmount) (MasterChef_New.sol#1117)
                - tbullReferral.recordReferralCommission(referrer,commissionAmount) (MasterChef_New.sol#1118)
        Event emitted after the call(s):
        - ReferralCommissionPaid(_user,referrer,commissionAmount) (MasterChef_New.sol#1119)
                - payReferralCommission(msg.sender,totalRewards) (MasterChef_New.sol#1055)
Reentrancy in MasterChef.payReferralCommission(address,uint256) (MasterChef_New.sol#1111-1122):
        External calls:
        - tbull.mint(referrer,commissionAmount) (MasterChef_New.sol#1117)
        - tbullReferral.recordReferralCommission(referrer,commissionAmount) (MasterChef_New.sol#1118)
        Event emitted after the call(s):
        - ReferralCommissionPaid(_user,referrer,commissionAmount) (MasterChef_New.sol#1119)
Reentrancy in MasterChef.updateEmissionRate(uint256) (MasterChef_New.sol#1093-1097):
        External calls:
        - massUpdatePools() (MasterChef_New.sol#1094)
                - tbull.mint(devAddress,tbullReward.div(10)) (MasterChef_New.sol#974)
                - tbull.mint(address(this),tbullReward) (MasterChef_New.sol#975)
        Event emitted after the call(s):
        - EmissionRateUpdated(msg.sender,tbullPerBlock,_tbullPerBlock) (MasterChef_New.sol#1095)
```

```
Reentrancy in MasterChef.withdraw(uint256,uint256) (MasterChef_New.sol#1007-1019):
        External calls:
        - updatePool(_pid) (MasterChef_New.sol#1011)
                - tbull.mint(devAddress,tbullReward.div(10)) (MasterChef_New.sol#974)
                - tbull.mint(address(this),tbullReward) (MasterChef_New.sol#975)
        - payOrLockupPendingIbull(_pid) (MasterChef_New.sol#1012)
                - tbull.transfer(_to,tbullBal) (MasterChef_New.sol#1073)
                - tbull.transfer(_to,_amount) (MasterChef_New.sol#1075)
                - tbull.mint(referrer,commissionAmount) (MasterChef_New.sol#1117)
                - tbullReferral.recordReferralCommission(referrer,commissionAmount) (MasterChef_New.sol#1118)
        Event emitted after the call(s):
        - ReferralCommissionPaid(_user,referrer,commissionAmount) (MasterChef_New.sol#1119)
                - payOrLockupPendingIbull(_pid) (MasterChef_New.sol#1012)
        - RewardLockedUp(msg.sender,_pid,pending) (MasterChef_New.sol#1060)
                - payOrLockupPendingIbull(_pid) (MasterChef_New.sol#1012)
Reentrancy in MasterChef.withdraw(uint256,uint256) (MasterChef_New.sol#1007-1019):
        External calls:
        - updatePool(_pid) (MasterChef_New.sol#1011)
                - tbull.mint(devAddress,tbullReward.div(10)) (MasterChef_New.sol#974)
                - tbull.mint(address(this),tbullReward) (MasterChef_New.sol#975)
        - payOrLockupPendingIbull(_pid) (MasterChef_New.sol#1012)
                - tbull.transfer(_to,tbullBal) (MasterChef_New.sol#1073)
                - tbull.transfer(_to,_amount) (MasterChef_New.sol#1075)
                - tbull.mint(referrer,commissionAmount) (MasterChef_New.sol#1117)
                - tbullReferral.recordReferralCommission(referrer,commissionAmount) (MasterChef_New.sol#1118)
        - pool.lpToken.safeTransfer(address(msg.sender),_amount) (MasterChef_New.sol#1015)
        Event emitted after the call(s):
        - Withdraw(msg.sender,_pid,_amount) (MasterChef_New.sol#1018)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#reentrancy-vulnerabilities-3

IBullSwap.delegateBySig(address,uint256,uint256,uint8,bytes32,bytes32) (MasterChef_New.sol#639-688) uses timestamp for comparisons
        Dangerous comparisons:
        - require(bool,string)(now <= expiry,IBULL::delegateBySig: signature expired) (MasterChef_New.sol#678)
MasterChef.canHarvest(uint256,address) (MasterChef_New.sol#948-951) uses timestamp for comparisons
        Dangerous comparisons:
        - block.timestamp >= user.nextHarvestUntil (MasterChef_New.sol#950)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#block-timestamp

Address.isContract(address) (MasterChef_New.sol#88-92) uses assembly
        - INLINE ASM (MasterChef_New.sol#90)
Address._verifyCallResult(bool,bytes,string) (MasterChef_New.sol#129-142) uses assembly
        - INLINE ASM (MasterChef_New.sol#134-137)
IBullSwap.getChainId() (MasterChef_New.sol#798-802) uses assembly
        - INLINE ASM (MasterChef_New.sol#800)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#assembly-usage
```

Smart Contract Audit

```
Address.functionCall(address,bytes) (MasterChef_New.sol#98-100) is never used and should be removed
Address.functionCallWithValue(address,bytes,uint256) (MasterChef_New.sol#104-106) is never used and should be removed
Address.functionDelegateCall(address,bytes) (MasterChef_New.sol#121-123) is never used and should be removed
Address.functionDelegateCall(address,bytes,string) (MasterChef_New.sol#124-128) is never used and should be removed
Address.functionStaticCall(address,bytes) (MasterChef_New.sol#113-115) is never used and should be removed
Address.functionStaticCall(address,bytes,string) (MasterChef_New.sol#116-120) is never used and should be removed
Address.sendValue(address,uint256) (MasterChef_New.sol#93-97) is never used and should be removed
BEP20._burn(address,uint256) (MasterChef_New.sol#519-525) is never used and should be removed
BEP20._burnFrom(address,uint256) (MasterChef_New.sol#558-565) is never used and should be removed
Context._msgData() (MasterChef_New.sol#222-225) is never used and should be removed
SafeBEP20.safeApprove(IBEP20,address,uint256) (MasterChef_New.sol#167-177) is never used and should be removed
SafeBEP20.safeDecreaseAllowance(IBEP20,address,uint256) (MasterChef_New.sol#188-190) is never used and should be removed
SafeBEP20.safeIncreaseAllowance(IBEP20,address,uint256) (MasterChef_New.sol#179-186) is never used and should be removed
SafeMath.div(uint256,uint256,string) (MasterChef_New.sol#78-79) is never used and should be removed
SafeMath.mod(uint256,uint256) (MasterChef_New.sol#68-71) is never used and should be removed
SafeMath.mod(uint256,uint256,string) (MasterChef_New.sol#80-83) is never used and should be removed
SafeMath.tryAdd(uint256,uint256) (MasterChef_New.sol#26-30) is never used and should be removed
SafeMath.tryDiv(uint256,uint256) (MasterChef_New.sol#41-44) is never used and should be removed
SafeMath.tryMod(uint256,uint256) (MasterChef_New.sol#45-48) is never used and should be removed
SafeMath.tryMul(uint256,uint256) (MasterChef_New.sol#35-40) is never used and should be removed
SafeMath.trySub(uint256,uint256) (MasterChef_New.sol#31-34) is never used and should be removed
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#dead-code

Pragma version>=0.4.0 (MasterChef_New.sol#8) allows old versions
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#incorrect-versions-of-solidity

Low level call in Address.sendValue(address,uint256) (MasterChef_New.sol#93-97):
        - (success) = recipient.call{value: amount}() (MasterChef_New.sol#95)
Low level call in Address.functionCallWithValue(address,bytes,uint256,string) (MasterChef_New.sol#107-112):
        - (success,returndata) = target.call{value: value}(data) (MasterChef_New.sol#110)
Low level call in Address.functionStaticCall(address,bytes,string) (MasterChef_New.sol#116-120):
        - (success,returndata) = target.staticcall(data) (MasterChef_New.sol#118)
Low level call in Address.functionDelegateCall(address,bytes,string) (MasterChef_New.sol#124-128):
        - (success,returndata) = target.delegatecall(data) (MasterChef_New.sol#126)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#low-level-calls

Parameter IBullSwap.mint(address,uint256)._to (MasterChef_New.sol#603) is not in mixedCase
Parameter IBullSwap.mint(address,uint256)._amount (MasterChef_New.sol#603) is not in mixedCase
Constant IBullSwap._initialSupply (MasterChef_New.sol#570) is not in UPPER_CASE_WITH_UNDERSCORES
Variable IBullSwap._delegates (MasterChef_New.sol#572) is not in mixedCase
Parameter MasterChef.add(uint256,IBEP20,uint16,uint256,bool)._allocPoint (MasterChef_New.sol#896) is not in mixedCase
Parameter MasterChef.add(uint256,IBEP20,uint16,uint256,bool)._lpToken (MasterChef_New.sol#896) is not in mixedCase
Parameter MasterChef.add(uint256,IBEP20,uint16,uint256,bool)._depositFeeBP (MasterChef_New.sol#896) is not in mixedCase
Parameter MasterChef.add(uint256,IBEP20,uint16,uint256,bool)._harvestInterval (MasterChef_New.sol#896) is not in mixedCase
Parameter MasterChef.add(uint256,IBEP20,uint16,uint256,bool)._withUpdate (MasterChef_New.sol#896) is not in mixedCase
Parameter MasterChef.set(uint256,uint256,uint16,uint256,bool)._pid (MasterChef_New.sol#915) is not in mixedCase
Parameter MasterChef.set(uint256,uint256,uint16,uint256,bool)._allocPoint (MasterChef_New.sol#915) is not in mixedCase
Parameter MasterChef.set(uint256,uint256,uint16,uint256,bool)._depositFeeBP (MasterChef_New.sol#915) is not in mixedCase
Parameter MasterChef.set(uint256,uint256,uint16,uint256,bool)._harvestInterval (MasterChef_New.sol#915) is not in mixedCase
Parameter MasterChef.set(uint256,uint256,uint16,uint256,bool)._withUpdate (MasterChef_New.sol#915) is not in mixedCase
Parameter MasterChef.getMultiplier(uint256,uint256)._from (MasterChef_New.sol#928) is not in mixedCase
Parameter MasterChef.getMultiplier(uint256,uint256)._to (MasterChef_New.sol#928) is not in mixedCase
Parameter MasterChef.pendingIbull(uint256,address)._pid (MasterChef_New.sol#933) is not in mixedCase
Parameter MasterChef.pendingIbull(uint256,address)._user (MasterChef_New.sol#933) is not in mixedCase
Parameter MasterChef.canHarvest(uint256,address)._pid (MasterChef_New.sol#948) is not in mixedCase
Parameter MasterChef.canHarvest(uint256,address)._user (MasterChef_New.sol#948) is not in mixedCase
Parameter MasterChef.updatePool(uint256)._pid (MasterChef_New.sol#962) is not in mixedCase
Parameter MasterChef.deposit(uint256,uint256,address)._pid (MasterChef_New.sol#981) is not in mixedCase
Parameter MasterChef.deposit(uint256,uint256,address)._amount (MasterChef_New.sol#981) is not in mixedCase
Parameter MasterChef.deposit(uint256,uint256,address)._referrer (MasterChef_New.sol#981) is not in mixedCase
Parameter MasterChef.withdraw(uint256,uint256)._pid (MasterChef_New.sol#1007) is not in mixedCase
Parameter MasterChef.withdraw(uint256,uint256)._amount (MasterChef_New.sol#1007) is not in mixedCase
Parameter MasterChef.emergencyWithdraw(uint256)._pid (MasterChef_New.sol#1022) is not in mixedCase
Parameter MasterChef.payOrLockupPendingIbull(uint256)._pid (MasterChef_New.sol#1033) is not in mixedCase
Parameter MasterChef.safeIbullTransfer(address,uint256)._to (MasterChef_New.sol#1070) is not in mixedCase
Parameter MasterChef.safeIbullTransfer(address,uint256)._amount (MasterChef_New.sol#1070) is not in mixedCase
Parameter MasterChef.setDevAddress(address)._devAddress (MasterChef_New.sol#1080) is not in mixedCase
Parameter MasterChef.setFeeAddress(address)._feeAddress (MasterChef_New.sol#1086) is not in mixedCase
Parameter MasterChef.updateEmissionRate(uint256)._ibullPerBlock (MasterChef_New.sol#1093) is not in mixedCase
Parameter MasterChef.setIbullReferral(IIBullSwapReferral)._ibullReferral (MasterChef_New.sol#1100) is not in mixedCase
Parameter MasterChef.setReferralCommissionRate(uint16)._referralCommissionRate (MasterChef_New.sol#1105) is not in mixedCase
Parameter MasterChef.payReferralCommission(address,uint256)._user (MasterChef_New.sol#1111) is not in mixedCase
Parameter MasterChef.payReferralCommission(address,uint256)._pending (MasterChef_New.sol#1111) is not in mixedCase
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#conformance-to-solidity-naming-conventions

Redundant expression "this (MasterChef_New.sol#223)" inContext (MasterChef_New.sol#218-226)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#redundant-statements
```

```
BEP20._mint(address,uint256) (MasterChef_New.sol#495-506) uses literals with too many digits:
        - maxSupply = 100000000000 * 10 ** 18 (MasterChef_New.sol#498)
IBullSwap.slitherConstructorConstantVariables() (MasterChef_New.sol#568-803) uses literals with too many digits:
        - _initialSupply = 2000000000 * 10 ** 18 (MasterChef_New.sol#570)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#too-many-digits

renounceOwnership() should be declared external:
        - Ownable.renounceOwnership() (MasterChef_New.sol#246-249)
transferOwnership(address) should be declared external:
        - Ownable.transferOwnership(address) (MasterChef_New.sol#250-254)
decimals() should be declared external:
        - BEP20.decimals() (MasterChef_New.sol#323-325)
symbol() should be declared external:
        - BEP20.symbol() (MasterChef_New.sol#330-332)
totalSupply() should be declared external:
        - BEP20.totalSupply() (MasterChef_New.sol#337-339)
transfer(address,uint256) should be declared external:
        - BEP20.transfer(address,uint256) (MasterChef_New.sol#350-359)
allowance(address,address) should be declared external:
        - BEP20.allowance(address,address) (MasterChef_New.sol#364-366)
approve(address,uint256) should be declared external:
        - BEP20.approve(address,uint256) (MasterChef_New.sol#375-378)
transferFrom(address,address,uint256) should be declared external:
        - BEP20.transferFrom(address,address,uint256) (MasterChef_New.sol#392-404)
increaseAllowance(address,uint256) should be declared external:
        - BEP20.increaseAllowance(address,uint256) (MasterChef_New.sol#418-421)
decreaseAllowance(address,uint256) should be declared external:
        - BEP20.decreaseAllowance(address,uint256) (MasterChef_New.sol#437-444)
mint(uint256) should be declared external:
        - BEP20.mint(uint256) (MasterChef_New.sol#454-457)
mint(address,uint256) should be declared external:
        - IBullSwap.mint(address,uint256) (MasterChef_New.sol#685-688)
add(uint256,IBEP20,uint16,uint256,bool) should be declared external:
        - MasterChef.add(uint256,IBEP20,uint16,uint256,bool) (MasterChef_New.sol#896-912)
set(uint256,uint256,uint16,uint256,bool) should be declared external:
        - MasterChef.set(uint256,uint256,uint16,uint256,bool) (MasterChef_New.sol#915-925)
withdraw(uint256,uint256) should be declared external:
        - MasterChef.withdraw(uint256,uint256) (MasterChef_New.sol#1007-1019)
emergencyWithdraw(uint256) should be declared external:
        - MasterChef.emergencyWithdraw(uint256) (MasterChef_New.sol#1022-1032)
approve(address,address,uint256) should be declared external:
        - MasterChef.approve(address,address,uint256) (MasterChef_New.sol#1064-1067)
setDevAddress(address) should be declared external:
        - MasterChef.setDevAddress(address) (MasterChef_New.sol#1080-1084)
setFeeAddress(address) should be declared external:
        - MasterChef.setFeeAddress(address) (MasterChef_New.sol#1086-1090)
updateEmissionRate(uint256) should be declared external:
        - MasterChef.updateEmissionRate(uint256) (MasterChef_New.sol#1093-1097)
setIbullReferral(IIBullSwapReferral) should be declared external:
        - MasterChef.setIbullReferral(IIBullSwapReferral) (MasterChef_New.sol#1100-1102)
setReferralCommissionRate(uint16) should be declared external:
        - MasterChef.setReferralCommissionRate(uint16) (MasterChef_New.sol#1105-1108)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#public-function-that-could-be-declared-external
```

MythX: -

```
Report for MasterChef_New.sol
https://dashboard.mythx.io/#/console/analyses/f211fadc-5e75-421d-81e1-e240c8db5296
```

Line	SWC Title	Severity	Short Description
6	(SWC-103) Floating Pragma	Low	A floating pragma is set.
788	(SWC-120) Weak Sources of Randomness from Chain Attributes	Low	Potential use of "block.number" as source of randonnness.
781	(SWC-120) Weak Sources of Randomness from Chain Attributes	Low	Potential use of "block.number" as source of randonnness.
886	(SWC-123) Requirement Violation	Low	Requirement violation.
902	(SWC-120) Weak Sources of Randomness from Chain Attributes	Low	Potential use of "block.number" as source of randonnness.
937	(SWC-123) Requirement Violation	Low	Requirement violation.
938	(SWC-120) Weak Sources of Randomness from Chain Attributes	Low	Potential use of "block.number" as source of randonnness.
939	(SWC-120) Weak Sources of Randomness from Chain Attributes	Low	Potential use of "block.number" as source of randonnness.
964	(SWC-120) Weak Sources of Randomness from Chain Attributes	Low	Potential use of "block.number" as source of randonnness.
969	(SWC-120) Weak Sources of Randomness from Chain Attributes	Low	Potential use of "block.number" as source of randonnness.
972	(SWC-120) Weak Sources of Randomness from Chain Attributes	Low	Potential use of "block.number" as source of randonnness.
977	(SWC-120) Weak Sources of Randomness from Chain Attributes	Low	Potential use of "block.number" as source of randonnness.

Solhint: -

Linter results:

```
MasterChef_New.sol:6:1: Error: Compiler version >=0.4.0 does not satisfy the r semver requirement

MasterChef_New.sol:90:9: Error: Avoid to use inline assembly. It is acceptable only in rare cases

MasterChef_New.sol:95:28: Error: Avoid to use low level calls.

MasterChef_New.sol:110:51: Error: Avoid to use low level calls.

MasterChef_New.sol:126:51: Error: Avoid to use low level calls.

MasterChef_New.sol:134:17: Error: Avoid to use inline assembly. It is acceptable only in rare cases

MasterChef_New.sol:401:59: Error: Use double quotes for string literals

MasterChef_New.sol:441:69: Error: Use double quotes for string literals

MasterChef_New.sol:478:39: Error: Use double quotes for string literals

MasterChef_New.sol:479:42: Error: Use double quotes for string literals

MasterChef_New.sol:481:59: Error: Use double quotes for string literals

MasterChef_New.sol:497:40: Error: Use double quotes for string literals

MasterChef_New.sol:520:40: Error: Use double quotes for string literals

MasterChef_New.sol:522:61: Error: Use double quotes for string literals

MasterChef_New.sol:545:38: Error: Use double quotes for string literals

MasterChef_New.sol:546:40: Error: Use double quotes for string literals
```

```
MasterChef_New.sol:563:60: Error: Use double quotes for string literals

MasterChef_New.sol:568:29: Error: Use double quotes for string literals

MasterChef_New.sol:568:42: Error: Use double quotes for string literals

MasterChef_New.sol:570:30: Error: Constant name must be in capitalized SNAKE_CASE

MasterChef_New.sol:678:17: Error: Avoid to make time-based decisions in your business logic

MasterChef_New.sol:800:9: Error: Avoid to use inline assembly. It is acceptable only in rare cases

MasterChef_New.sol:950:16: Error: Avoid to make time-based decisions in your business logic

MasterChef_New.sol:1040:37: Error: Avoid to make time-based decisions in your business logic

MasterChef_New.sol:1051:41: Error: Avoid to make time-based decisions in your business logic
```

Basic Coding Bugs

1. **Constructor Mismatch**
   - Description: Whether the contract name and its constructor are not identical to each other.
   - Result: PASSED
   - Severity: Critical
2. **Ownership Takeover**
   - Description: Whether the set owner function is not protected.
   - Result: PASSED
   - Severity: Critical
3. **Redundant Fallback Function**
   - Description: Whether the contract has a redundant fallback function.
   - Result: PASSED
   - Severity: Critical
4. **Overflows & Underflows**
   - Description: Whether the contract has general overflow or underflow vulnerabilities
   - Result: PASSED
   - Severity: Critical
5. **Reentrancy**
   - Description: Reentrancy is an issue when code can call back into your contract and change state, such as withdrawing ETHs.
   - Result: PASSED
   - Severity: Critical
6. **MONEY-Giving Bug**
   - Description: Whether the contract returns funds to an arbitrary address.
   - Result: PASSED
   - Severity: High

7. **Blackhole**

   - Description: Whether the contract locks ETH indefinitely: merely in without out.
   - Result: PASSED
   - Severity: High

8. **Unauthorized Self-Destruct**

   - Description: Whether the contract can be killed by any arbitrary address.
   - Result: PASSED
   - Severity: Medium

9. **Revert DoS**

   - Description: Whether the contract is vulnerable to DoS attack because of unexpected revert.
   - Result: PASSED
   - Severity: Medium

10. **Unchecked External Call**

    - Description: Whether the contract has any external call without checking the return value.
    - Result: PASSED
    - Severity: Medium

11. **Gasless Send**

    - Description: Whether the contract is vulnerable to gasless send.
    - Result: PASSED
    - Severity: Medium

12. **Send Instead of Transfer**

    - Description: Whether the contract uses send instead of transfer.
    - Result: PASSED
    - Severity: Medium

13. **Costly Loop**

- Description: Whether the contract has any costly loop which may lead to Out-Of-Gas exception.
- Result: PASSED
- Severity: Medium

14. **(Unsafe) Use of Untrusted Libraries**

- Description: Whether the contract use any suspicious libraries.
- Result: PASSED
- Severity: Medium

15. **(Unsafe) Use of Predictable Variables**

- Description: Whether the contract contains any randomness variable, but its value can be predicated.
- Result: PASSED
- Severity: Medium

16. **Transaction Ordering Dependence**

- Description: Whether the final state of the contract depends on the order of the transactions.
- Result: PASSED
- Severity: Medium

17. **Deprecated Uses**

- Description: Whether the contract use the deprecated tx.origin to perform the authorization.
- Result: PASSED
- Severity: Medium

Semantic Consistency Checks

- Description: Whether the semantic of the white paper is different from the implementation of the contract.
- Result: PASSED
- Severity: Critical

Conclusion

In this audit, we thoroughly analyzed IBULLSWAP's MasterChef Smart Contract. The current code base is well organized but there are promptly some low-level issues found in the first phase of Smart Contract Audit.

Meanwhile, we need to emphasize that smart contracts as a whole are still in an early, but exciting stage of development. To improve this report, we greatly appreciate any constructive feedbacks or suggestions, on our methodology, audit findings, or potential gaps in scope/coverage.

About eNebula Solutions

We believe that people have a fundamental need to security and that the use of secure solutions enables every person to more freely use the Internet and every other connected technology. We aim to provide security consulting service to help others make their solutions more resistant to unauthorized access to data & inadvertent manipulation of the system. We support teams from the design phase through the production to launch and surely after.

The eNebula Solutions team has skills for reviewing code in C, C++, Python, Haskell, Rust, Node.js, Solidity, Go, and JavaScript for common security vulnerabilities & specific attack vectors. The team has reviewed implementations of cryptographic protocols and distributed system architecture, including in cryptocurrency, blockchains, payments, and smart contracts. Additionally, the team can utilize various tools to scan code & networks and build custom tools as necessary.

Although we are a small team, we surely believe that we can have a momentous impact on the world by being translucent and open about the work we do.

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