Protocol Audit Report

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TSwap Protocol Audit Report

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Protocol Summary

The protocol implements an automated market maker (AMM) for token swaps, with features including liquidity provision, token swapping, and pool management.

Disclaimer

The audit team makes all effort to find as many vulnerabilities in the code in the given time period, but holds no responsibilities for the findings provided in this document. A security audit is not an endorsement of the underlying business or product. The audit was time-boxed and the review of the code was solely on the security aspects of the Solidity implementation of the contracts.

Risk Classification

		Impact		
		High	Medium	Low
	High	H	H/M	M
Likelihood	Medium	H/M	M	M/L
	Low	M	M/L	L

Audit Details

Scope

- TSwapPool.sol
- PoolFactory.sol
- [Other contract files in scope]

Roles

- Liquidity Providers: Users who provide liquidity to pools
- Traders: Users who perform token swaps
- Protocol Admin: Administrative role for protocol management

Executive Summary

Issues Found

Severity	Number of Issues
High	7
Medium	5
Low	4
Info	6
Total	22

Findings

High Severity

[H-1] Missing deadline check in `TSwapPool::deposit` enables sandwich attacks

Description: The `deposit` function accepts a deadline parameter but never uses it, allowing transactions to be executed at unexpected times when market conditions are unfavorable.

Impact: Users may have their transactions executed at unfavorable rates due to MEV attacks or market movements.

Proof of Concept:

```
function deposit(
    uint256 wethToDeposit,
    uint256 minimumLiquidityTokensToMint,
    uint256 maximumPoolTokensToDeposit,
    uint64 deadline
) external returns (uint256)
```

Recommended Mitigation:

```
function deposit(
    uint256 wethToDeposit,
    uint256 minimumLiquidityTokensToMint,
    uint256 maximumPoolTokensToDeposit,
    uint64 deadline
) external
+ revertIfDeadlinePassed(deadline)
```

[H-2] Incorrect fee calculation in `getInputAmountBasedOnOutput` causes excess fee collection

Description: The function scales the fee amount by 10_000 instead of 1_000, resulting in users paying 10x more in fees than intended.

Impact: Users lose funds by paying excessive fees on every swap operation.

Proof of Concept:

```
return ((inputReserves * outputAmount) * 10_000) / ((outputReserves - outputAmount) * 997);
```

Recommended Mitigation:

```
- return ((inputReserves * outputAmount) * 10_000) / ((outputReserves - outputAmount) * 997)
+ return ((inputReserves * outputAmount) * 1_000) / ((outputReserves - outputAmount) * 997);
```

[H-3] Critical reentrancy vulnerability in swap functions

Description: The swap functions do not implement reentrancy guards and make external calls before updating state variables.

Impact: Malicious contracts could reenter the protocol and drain funds through repeated swaps.

Proof of Concept:

```
function withdraw(uint amount) public {
    require(balances[msg.sender] >= amount);
    msg.sender.call{value: amount}("");  // Vulnerable external call
    balances[msg.sender] -= amount;
}
```

Recommended Mitigation:

1. Implement ReentrancyGuard
2. Follow checks-effects-interactions pattern

```
+ import "@openzeppelin/contracts/security/ReentrancyGuard.sol";

- function withdraw(uint amount) public {
+ function withdraw(uint amount) public nonReentrant {
    require(balances[msg.sender] >= amount);
+   balances[msg.sender] -= amount;
    msg.sender.call{value: amount}("");
-   balances[msg.sender] -= amount;
}
```

[H-4] Protocol invariant broken by extra token distribution

Description: The `_swap` function gives extra tokens after every `SWAP_COUNT_MAX` swaps, breaking the x * y = k invariant.

Impact: Protocol funds can be drained through repeated swaps to collect bonus tokens.

Proof of Concept: [Previous POC code from manager's report]

Recommended Mitigation: Remove the bonus token distribution or account for it in the protocol's invariant calculations.

[Continue with H-5, H-6, H-7...]

Medium Severity

[M-1] Missing input validation for critical parameters

Description: Several functions lack proper input validation for critical parameters, allowing zero or invalid values.

Impact: Could lead to function reverts or incorrect calculations.

Recommended Mitigation:

```
function setParameters(uint256 value) public {
+   require(value > 0 && value <= MAX_VALUE, "Invalid value");
    parameter = value;
}
```

[Continue with M-2 through M-5...]

Low Severity

[L-1] Event parameter ordering in `LiquidityAdded`

Description: Parameters in the `LiquidityAdded` event are emitted in incorrect order.

Impact: Off-chain tools may misinterpret event data.

Recommended Mitigation:

```
- emit LiquidityAdded(msg.sender, poolTokensToDeposit, wethToDeposit);
+ emit LiquidityAdded(msg.sender, wethToDeposit, poolTokensToDeposit);
```

[Continue with L-2 through L-4...]

Informational

[I-1] Lack of zero address validation

Description: Constructor and critical functions missing zero address validation.

Impact: Could lead to contract lockup if zero address is provided.

Recommended Mitigation:

```
constructor(address wethToken) {
+   require(wethToken != address(0), "Zero address not allowed");
    i_wethToken = wethToken;
}
```

[Continue with remaining informational findings...]

Additional Recommendations

1. Implement comprehensive input validation across all functions
2. Add events for all critical state changes
3. Improve documentation and NatSpec comments
4. Implement proper access control mechanisms
5. Add comprehensive unit tests
6. Consider implementing emergency pause functionality
7. Use latest stable Solidity version
8. Implement proper slippage protection mechanisms

Conclusion

The protocol contains several critical vulnerabilities that need immediate attention, particularly around swap mechanics, reentrancy protection, and protocol invariants. While the core functionality is well-implemented, several security measures are missing or incorrectly implemented.

Key areas for improvement:

1. Transaction deadline enforcement
2. Fee calculation accuracy
3. Reentrancy protection
4. Input validation
5. Event emissions
6. Access control

We recommend addressing all high and medium severity findings before deployment to mainnet.