

WithdrawalQueueERC721

- [Source code](#)
- [Deployed contract](#)

A FIFO queue for stETH withdrawal requests and an unstETH NFT implementation representing the position in the queue.

Access to lever methods is restricted using the functionality of the [AccessControlEnumerable](#) contract and a bunch of [granular roles](#).

What is WithdrawalQueueERC721?

This contract is a main entry point to exchange stETH for underlying ether directly via Lido protocol. It is responsible for:

- managing a queue of withdrawal requests
- committing withdrawal request finalization as a part of the [AccountingOracle](#)
- report
- storing stETH
- before and after the finalization
- transfer reserved ether to the user upon the claim

Also, the contract is [ERC-721](#) unstETH NFT with metadata extension representing the right to claim underlying ether once the request is finalized. This NFT is minted upon request and burned on the claim. [ERC-4906](#) is used to update the metadata as soon as the finalization status of the request is changed.

Request

To request a withdrawal, one needs to approve the amount of stETH or wstETH to this contract or sign the [ERC-2612 Permit](#), and then call the appropriate `requestWithdrawals*` method.

The minimal amount for a request is 100 wei, and the maximum is 1000 eth. More significant amounts should be split into several requests, which allows us to avoid clogging the queue with an extra large request.

During this call, the request is placed in the queue, and the related unstETH NFT is minted. The following structure represents the request:

struct

WithdrawalRequestStatus

```
{ uint256 amountOfStETH ; uint256 amountOfShares ; address owner ; uint256 timestamp ; bool isFinalized ; bool isClaimed ; } where
```

- amountOfStETH
- — the number of stETH
- tokens transferred to the contract upon request
- amountOfShares
- — the number of underlying shares corresponding to transferred stETH
- tokens.
- See [Lido rebasing chapter](#)
- to learn about the shares mechanic
- owner
- — the owner's address for this request. The owner is also a holder of the unstETH
- NFT
- and can transfer the ownership and claim the underlying ether once finalized
- timestamp
- — the creation time of the request
- isFinalized
- — finalization status of the request; finalized requests are available to claim
- isClaimed
- — the claim status of the request. Once claimed, NFT is burned, and
- the request is not available to claim again

note The amount of ether that will be withdrawn is limited to the number of stETH tokens transferred to this contract at the moment of request. So, the user will not receive the rewards for the period of time while their tokens stay in the queue.

Finalization

After filing a withdrawal request, one can only claim it once finalization occurs. [Accounting Oracle](#) report finalizes a batch of withdrawal requests, choosing the `_maxShareRate` and the size of the batch taking in account following factors:

- If there is enough ether to fulfill the request. Ether can be obtained from the Lido buffer, which is filled
- from the new users' stake, Beacon chain partial and full withdrawals, protocol tips, and MEV rewards.
- Withdrawals are prioritized over deposits, so ether can't be deposited to the Beacon chain if some withdrawal requests
- can be fulfilled.
- if enough time has passed since the withdrawal request was placed in the queue (timelock)
- If there was some massive loss for the protocol on the Beacon Chain side since the withdrawal request was filed.
- It can lead to finalization by the rate lower than 1:1 if the loss will be high enough to be not covered
- with daily rewards (never happened before)

note To put it simply, token holders don't receive rewards but still take risks during withdrawal. Rewards, acquired since the stETH was locked in the WithdrawalQueue, are burned upon the finalization, effectively distributing them among the other token holders. So, the finalization sets the final value of the request, locks ether on the balance of this contract, and burns the underlying stETH and the queue may look like this in arbitrary moment:

Claim

When the request is finalized, it can be claimed by the current owner, transferring the reserved amount of ether to the recipient's address and burning the withdrawal NFT.

To see if the request is claimable, one can get its status using `getWithdrawalStatus()` or subscribe to the `eventWithdrawalsFinalized(uint256 from, uint256 to, ...)`, which is emitted once the batch of requests with ids in the range `(from, to]` is finalized.

Standards

Contract implements the following Ethereum standards:

- [ERC-721: Non-Fungible Token Standard](#)
- [ERC-165: Standard Interface Detection](#)
- [ERC-4906: EIP-721 Metadata Update Extension](#)

ERC-721

-related Methods

name()

Returns the token collection name.

function

name ()

view

returns

(string

memory)

symbol()

Returns the token collection symbol.

function

symbol ()

view

returns

(string

memory)

tokenURI()

Returns the Uniform Resource Identifier (URI) for the `_requestId` token. Returns an empty string if no base URI and `noNFTDescriptor` address are set.

function

`tokenURI (uint256 _requestId)`

view

returns

(string

memory)

balanceOf()

Returns the number of tokens in the `_owner` 's account.

function

`balanceOf (address _owner)`

view

returns

(uint256 balance) note Reverts if `_owner` is zero address

ownerOf()

Returns the owner of the `_requestId` token.

function

`ownerOf (uint256 _requestId)`

view

returns

(address owner) note Requirements:

- `_requestId`
- request must exist.
- `_requestId`
- request must not be claimed.

approve()

Gives permission to `_to` to transfer the `_requestId` token to another account. The approval is cleared when the token is transferred.

Emits an `Approval` event.

function

`approve (address _to ,`

`uint256 _requestId)` note Requirements:

- The caller must own the token or be an approved operator.
- `_requestId`
- must exist.
- `_to`
- must not be the owner

getApproved()

Returns the account approved for the _requestId token.

function

getApproved (uint256 _requestId)

view

returns

(address) note Reverts if no_requestId exists

setApprovalForAll()

Approve or remove _operator as an operator for the caller. Operators can call transferFrom or safeTransferFrom for any token owned by the caller.

Emits an ApprovalForAll event.

function

setApprovalForAll (address _operator ,

bool _approved) note Reverts if msg.sender is equal to _operator

isApprovedForAll()

Return true if the _operator is allowed to manage all of the assets of the _owner .

function

isApprovedForAll (address _owner ,

address _operator)

view

returns

(bool)

safeTransferFrom()

Safely transfers the _requestId token from _from to _to , checking first that contract recipients are aware of the ERC721 protocol to prevent tokens from being forever locked. If a version with _data parameter is used, it passed to IERC721Receiver.onERC721Received() of the target smart contract as an argument.

Emits a Transfer event.

function

safeTransferFrom (address _from ,

address _to ,

uint256 _requestId) function

safeTransferFrom (address _from ,

address _to ,

uint256 _requestId ,

bytes

memory _data) note Requirements:

- _from
- cannot be the zero address.
- _to
- cannot be the zero address.
- _requestId

- token must exist and be owned by `_from`
- .
- If the caller is not `_from`
- , it must have been allowed to move this token by either `approve()`
- or `setApprovalForAll()`
- .
- If `_to`
- refers to a smart contract, it must implement `IERC721Receiver`
- interface

transferFrom()

Transfers the `_requestId` token from `_from` to `_to` .

Emits a `Transfer` event.

WARNING : Usage of this method is discouraged, use `safeTransferFrom()` whenever possible.

function

`transferFrom (address _from ,`

`address _to ,`

`uint256 _requestId)` note Requirements:

- `_from`
- cannot be the zero address.
- `_to`
- cannot be the zero address.
- `_requestId`
- token must be owned by `_from`
- .
- If the caller is not `_from`
- , it must be approved to move this token by either `approve()`
- or `setApprovalForAll()`
- .

getBaseUri()

Returns the base URI for computing token URI. If set, the resulting URI for each token will be the concatenation of the base URI and the `_requestId` .

function

`getBaseURI ()`

view

returns

(string

memory)

getNFTDescriptorAddress()

Returns the address of the `NFTDescriptor` contract responsible for the token URI generation.

function

`getNFTDescriptorAddress ()`

view

returns

(address)

ERC-165

-related Methods

supportsInterface()

Return true if this contract implements the interface defined by `interfaceId`. See the [ERC-165](#) to learn more about how these ids are created.

function

supportsInterface (bytes4 interfaceId)

view

returns

(bool) note This contract returns true for `IERC721`, `IERC721Metadata`, `IERC4906`, `IAccessControlEnumerable`, `IAccessControl` and `IERC165` itself.

Queue-related Methods

requestWithdrawals()

Batch request the `_amounts` of `stETH` for withdrawal to the `_owner` address. For each request, the respective amount of `stETH` is transferred to this contract address, and an `unstETH` NFT is minted to the `_owner` address.

function

requestWithdrawals (uint256 [] _amounts ,

address _owner)

returns

(uint256 [] requestIds) Returns the array of ids for each created request. Emits `WithdrawalRequested` and `Transfer` events.

note Requirements:

- withdrawals must not be paused
- `stETH`
- balance of `msg.sender`
- must be greater than the sum of all `_amounts`
- there must be approval from `msg.sender`
- to this contract address for the overall amount of `stETH`
- token transfer
- each amount in `_amounts`
- must be greater than `MIN_STETH_WITHDRAWAL_AMOUNT`
- and lower than `MAX_STETH_WITHDRAWAL_AMOUNT`

requestWithdrawalsWstETH()

Batch request the `_amounts` of `wstETH` for withdrawal to the `_owner` address. For each request, the respective amount of `wstETH` is transferred to this contract address, unwrapped to `stETH`, and an `unstETH` NFT is minted to the `_owner` address.

function

requestWithdrawalsWstETH (uint256 [] _amounts ,

address _owner)

returns

(uint256 [] requestIds) Returns the array of ids for each created request. Emits `WithdrawalRequested` and `Transfer` events.

note Requirements:

- withdrawals must not be paused
- `wstETH`
- balance of `msg.sender`
- must be greater than the sum of all `_amounts`
- there must be approval from `msg.sender`
- to this contract address for the overall amount of `wstETH`

- token transfer
- each amount in `_amounts`
- must have `getPooledEthByShares(amount)`
- being greater than `MIN_STETH_WITHDRAWAL_AMOUNT`
- and lower than `MAX_STETH_WITHDRAWAL_AMOUNT`

requestWithdrawalsWithPermit()

Batch request the `_amounts` of `stETH` for withdrawal to the `_owner` address. For each request, the respective amount of `stETH` is transferred to this contract address, and an `unstETH` NFT is minted to the `_owner` address. ERC-2612 permit is used to approve the token transfer.

function

`requestWithdrawalsWithPermit (uint256 [] _amounts , address _owner , PermitInput _permit)`

returns

`(uint256 [] requestIds)` where `_permit` is [ERC-2612](#) signed permit structure defined as:

struct

PermitInput

`{ uint256 value ; uint256 deadline ; uint8 v ; bytes32 r ; bytes32 s ; }` Returns the array of ids for each created request. Emits `WithdrawalRequested` and `Transfer` events.

note Requirements:

- withdrawals must not be paused
- `stETH`
- balance of `msg.sender`
- must be greater than the sum of all `_amounts`
- permit must have a valid signature, value
- greater than the sum of all `_amounts`
- , and the deadline
- not expired
- each amount in `_amounts`
- must be greater than `MIN_STETH_WITHDRAWAL_AMOUNT`
- and lower than `MAX_STETH_WITHDRAWAL_AMOUNT`

requestWithdrawalsWstETHWithPermit()

Batch request the `_amounts` of `wstETH` for withdrawal to the `_owner` address. For each request, the respective amount of `wstETH` is transferred to this contract address, unwrapped to `stETH` , and an `unstETH` NFT is minted to the `_owner` address. ERC-2612 permit is used to approve the token transfer.

function

`requestWithdrawalsWstETHWithPermit (uint256 [] _amounts , address _owner , PermitInput _permit)`

returns

`(uint256 [] requestIds)` where `_permit` is [ERC-2612](#) signed permit structure defined as:

struct

PermitInput

`{ uint256 value ; uint256 deadline ; uint8 v ; bytes32 r ; bytes32 s ; }` Returns the array of ids for each created request. Emits `WithdrawalRequested` and `Transfer` events.

note Requirements:

- withdrawals must not be paused
- `wstETH`
- balance of `msg.sender`
- must be greater than the sum of all `_amounts`
- permit must have a valid signature, value
- greater than the sum of all `_amounts`
- , and the deadline

- not expired
- each amount in `_amounts`
- must have `getPooledEthByShares(amount)`
- being greater than `MIN_STETH_WITHDRAWAL_AMOUNT`
- and lower than `MAX_STETH_WITHDRAWAL_AMOUNT`

getWithdrawalRequests()

Returns all withdrawal requests that belong to the `_owner` address.

function

`getWithdrawalRequests (address _owner)`

view

returns

(`uint256 [] requestIds`) warning This operation will copy the entire storage to memory, which can be quite expensive. This method is designed to mostly be used by view accessors that are queried without gas fees. Developers should keep in mind that this function has an unbounded cost, and using it as part of a state-changing function may render the function uncallable if the set grows to a point where copying to memory consumes too much gas to fit in a block.

getWithdrawalStatus()

Returns statuses for requests with ids in `_requestIds` .

function

`getWithdrawalStatus (uint256 [] _requestIds)` view returns

(`WithdrawalRequestStatus [] statuses`) Returns an array of `WithdrawalRequestStatus` structures, defined as:

struct

`WithdrawalRequestStatus`

{ `uint256 amountOfStETH` ; `uint256 amountOfShares` ; `address owner` ; `uint256 timestamp` ; `bool isFinalized` ; `bool isClaimed` ; } where

- `amountOfStETH`
- — the number of stETH
- tokens transferred to the contract upon request
- `amountOfShares`
- — the number of underlying shares corresponding to transferred stETH
- tokens.
- See [Lido rebasing chapter](#)
- to learn about the shares mechanic
- `owner`
- — the owner's address for this request. The owner is also a holder of the unstETH
- NFT
- and can transfer the ownership and claim the underlying ether once finalized
- `timestamp`
- — the creation time of the request
- `isFinalized`
- — finalization status of the request; finalized requests are available to claim
- `isClaimed`
- — the claim status of the request. Once claimed, NFT is burned, and the request
- is not available to claim again

getClaimableEther()

Returns amounts of ether available for claiming for each provided request id.

function

`getClaimableEther (uint256 [] _requestIds ,`

`uint256 [] _hints)` view returns

(`uint256 [] claimableEthValues`) where

- `_requestIds`
- — the array of request id to check the claimable ether for
- `_hints`
- — checkpoint hint for each request id. Can be obtained by calling [findCheckpointHints\(\)](#)

Returns the array of ether amounts available for claiming for each request id. The amount is equal to 0 if the request is not finalized or already claimed.

claimWithdrawalsTo()

Claim a batch of withdrawal requests if they are finalized, sending ether to `_recipient` address.

function

`claimWithdrawalsTo (uint256 [] _requestIds ,`

`uint256 [] _hints ,`

`address _recipient)` where

- `_requestIds`
- — the array of request id to check the claimable ether for
- `_hints`
- — checkpoint hint for each request id. Can be obtained by calling [findCheckpointHints\(\)](#)
- `_recipient`
- — the address of the recipient for claimed ether

Emits a batch of `Transfer` to zero address and `WithdrawalClaimed` events.

note Requirements:

- `all_requestIds`
- must exist, be finalized and not claimed
- `all_hints`
- must be valid for respective requests
- `msg.sender`
- must be the owner of all the requests
- `_recipient`
- must not be zero

claimWithdrawals()

Claim a batch of withdrawal requests if they are finalized, sending ether to `msg.sender` address.

function

`claimWithdrawals (uint256 [] _requestIds ,`

`uint256 [] _hints)` where

- `_requestIds`
- — the array of request id to check the claimable ether for
- `_hints`
- — checkpoint hint for each request id. Can be obtained by calling [findCheckpointHints\(\)](#)

Emits a batch of `Transfer` to zero address and `WithdrawalClaimed` events.

note Requirements:

- `all_requestIds`
- must exist, be finalized and not claimed
- `all_hints`
- must be valid for respective requests
- `msg.sender`
- must be the owner of all the requests

claimWithdrawal()

Claims the `_requestId` withdrawal request, sending ether to `msg.sender` address.

function

claimWithdrawal (uint256 _requestId) Emits aTransfer to zero address andWithdrawalClaimed event.

note Requirements:

- msg.sender
- must be the owner of the _requestId
- request
- _requestId
- request must exist, be finalized and not claimed

findCheckpointHints()

Returns an array of hints for the given _requestIds searching among the checkpoints with indices in the range[_firstIndex, _lastIndex] .

function

findCheckpointHints (uint256 [] _requestIds ,

uint256 _firstIndex ,

uint256 _lastIndex) view returns

(uint256 [] hintIds) note Requirements:

- Array of request ids must be sorted
- _firstIndex
- must be greater than 0, because checkpoint list is 1-based array
- _lastIndex
- must be less than or equal to [getLastCheckpointIndex\(\)](#)

isBunkerModeActive()

Returnstrue if bunker mode is active.

function

isBunkerModeActive ()

view

returns

(bool)

bunkerModeSinceTimestamp()

Returns the timestamp of the last bunker mode activation, if it's active now andBUNKER_MODE_DISABLED_TIMESTAMP if bunker mode is disabled (i.e., protocol in turbo mode).

function

bunkerModeSinceTimestamp ()

view

returns

(uint256)

getLastRequestId()

Returns the id of the last request in the queue.

function

getLastRequestId ()

view

returns

(uint256) note Requests are indexed from1 , so it returns0 if there are no requests in the queue.

getLastFinalizedRequestId()

Returns the id of the last finalized request in the queue.

function

getLastFinalizedRequestId ()

view

returns

(uint256) note Requests are indexed from1 , so it returns0 if there are no finalized requests in the queue.

getLockedEtherAmount()

Returns the amount of ether on the balance locked for withdrawal and available to claim.

function

getLockedEtherAmount ()

view

returns

(uint256)

getLastCheckpointIndex()

Returns the length of the checkpoint array. Last possible value for the hint.

function

getLastCheckpointIndex ()

view

returns

(uint256) note Checkpoints are indexed from1 , so it returns0 if there are no checkpoints yet.

unfinalizedRequestNumber()

Returns the number of unfinalized requests in the queue.

function

unfinalizedRequestNumber ()

view

returns

(uint256)

unfinalizedStETH()

Returns the amount of stETH in the queue yet to be finalized.

function

unfinalizedStETH ()

view

returns

(uint256)

calculateFinalizationBatches()

View for offchain use by the oracle daemon that calculates how many requests can be finalized within the given budget, time period, and share rate limits. Returned requests are split into batches. All requests belonging to one batch must have their share rate above or below (or equal) to the `_maxShareRate` . Below you can see an example of how 14 requests with different share rates will be split into five batches by this method:

^ share rate | | •• | ••••• |-----•----- _maxShareRate | ••••• | • +-----> requestId | 1 | 2 |3| 4 |
5 | batch number function

`calculateFinalizationBatches (uint256 _maxShareRate , uint256 _maxTimestamp , uint256 _maxRequestsPerCall ,
BatchesCalculationState _state)`

external

view

returns

(BatchesCalculationState) where

- `_maxShareRate`
- — the max share rate (ETH per share) that will be used for the finalization (1e27 precision)
- `_maxTimestamp`
- — the max timestamp of the request that can be finalized
- `_maxRequestsPerCall`
- — the max request number that can be processed per iteration
- `_state`
- — the current state of the calculation, represented with a `BatchesCalculationState`
- structure:
- struct
- `BatchesCalculationState`
- {
- `uint256`
- `remainingEthBudget`
- ;
- `bool`
- `finished`
- ;
- `uint256`
- [
- `MAX_BATCHES_LENGTH`
-]
- `batches`
- ;
- `uint256`
- `batchesLength`
- ;
- }
- - `remainingEthBudget`
- - — the currently remaining amount of ether. It must be set into the whole budget of
- - the finalization at the first call
- - `finished`
- - — the flag that is set to true
- - if all requests are iterated on
- - `batches`
- - — the resulting array of batches, each represented by the id of the last request in the batch
- - `batchesLength`
- - — the length of the filled part of the batches

- - array

Returns the current state of the finalization batch calculation.

note This method is designed for iterative usage under gas limits. So, in the case of the number of withdrawals are too large to iterate over in one call, one can use this method repeatedly, passing the return value as an argument for the next call as long as it returns finished equal to false

prefinalize()

Checks finalization batches and calculates the required amount of ether to lock and the number of shares to burn.

Designed to use during the oracle report to find the amount of ether to send along the finalize() call.

function

prefinalize (uint256 [] _batches ,

uint256 _maxShareRate) view returns

(uint256 ethToLock ,

uint256 sharesToBurn) where

- _batches
- — finalization batches calculated off-chain using calculateFinalizationBatches()
- _maxShareRate
- — max share rate (ETH per share) for request finalization (1e27 precision)

Returns

- ethToLock
- — the amount of ether to be sent with finalize()
- method
- sharesToBurn
- — the number of shares to be burnt to match this finalization call

Protected methods

Roles

- FINALIZE_ROLE
- — role to finalize withdrawal requests in the queue
- PAUSE_ROLE
- — role to pause the withdrawal on the protocol
- RESUME_ROLE
- — role to resume the withdrawal after being paused
- ORACLE_ROLE
- — role to provide required oracle-related data as the last report timestamp
- and if the protocol is in the bunker mode
- MANAGE_TOKEN_URI_ROLE
- — role to set the parameters for constructing the token URI: the base URI
- or NFTDescriptor
- address

finalize()

Finalize requests from the last finalized one up to _lastRequestIdToBeFinalized using _maxShareRate as a base share rate for ETH and passing along some ether as msg.value . The amount of ether to send should be precalculated by the prefinalize() method.

Emits a BatchMetadataUpdate and a WithdrawalsFinalized events.

function

finalize (uint256 _lastRequestIdToBeFinalized ,

uint256 _maxShareRate)

payable where

- `_lastRequestIdToBeFinalized`
- — the last request id to finalize
- `_maxShareRate`
- — the max share rate (ETH per share) for the request finalization (1e27 precision)

note Requirements:

- withdrawals must not be paused
- `msg.sender`
- must have the `FINALIZE_ROLE`
- assigned
- `_lastRequestIdToBeFinalized`
- must be an existing unfinalized request id
- `msg.value`
- must be less or equal to the sum of unfinalizedstETH
- up to `_lastRequestIdToBeFinalized`

pauseFor()

Pause withdrawal requests placement and finalization for particular `_duration` . Claiming finalized requests will still be available.

Emits a `Paused` event.

function

`pauseFor (uint256 _duration)`

`onlyRole (PAUSE_ROLE)` where

- `_duration`
- — pause duration in seconds (use `PAUSE_INFINITY`
- for unlimited)

note Requirements:

- `msg.sender`
- must have a `PAUSE_ROLE`
- assigned
- `_duration`
- must not be zero
- the contract must not be already paused

pauseUntil()

Pause withdrawal requests placement and finalization until `_pauseUntilInclusive` timestamp. Claiming finalized requests will still be available.

Emits a `Paused` event.

function

`pauseUntil (uint256 _pauseUntilInclusive)`

`onlyRole (PAUSE_ROLE)` where

- `_pauseUntilInclusive`
- — `theblock.timestamp`
- to pause until (inclusive)

note Requirements:

- `msg.sender`
- must have a `PAUSE_ROLE`
- assigned
- `_pauseUntilInclusive`
- must not be in the past
- the contract must not be already paused

resume()

Resumes withdrawal requests placement and finalization. The contract is deployed in a paused state and should be resumed explicitly.

Emits aResumed event.

function

resume () note Requirements:

- msg.sender
- must have aRESUME_ROLE
- assigned
- the contract must not be already resumed

onOracleReport()

Updates bunker mode state and last report timestamp.

Emits aBunkerModeEnabled or aBunkerModeDisabled event.

function

onOracleReport (bool _isBunkerModeNow , uint256 _bunkerStartTimestamp , uint256 _currentReportTimestamp) where

- _isBunkerModeNow
- — is bunker mode reported by the oracle
- _bunkerStartTimestamp
- — timestamp of the bunker mode activation
- _currentReportTimestamp
- — timestamp of the current report ref slot

note Requirements:

- msg.sender
- must have anORACLE_ROLE
- assigned
- all timestamps must be in the past

setBaseUri()

Sets the Base URI for computing token URI.

If theNFTDescriptor address isn't set, thebaseURI would be used for generating theERC-721 token URI. Otherwise, theNFTDescriptor address would be used as a first-priority method.

Emits aBaseURISet event

function

setBaseURI (string _baseURI)

external

onlyRole (MANAGE_TOKEN_URI_ROLE) where

- _baseURI
- — the base URI to derive the token URI from. Should not end on/

note Reverts ifmsg.sender has noMANAGE_TOKEN_URI_ROLE assigned.

setNFTDescriptorAddress()

Sets the address of theNFTDescriptor contract responsible for token URI generation.

If theNFTDescriptor address isn't set, thebaseURI would be used for generating theERC-721 token URI. Otherwise, theNFTDescriptor address would be used as a first-priority method.

Emits aNftDescriptorAddressSet event.

function

setNFTDescriptorAddress (address _nftDescriptorAddress)

onlyRole (MANAGE_TOKEN_URI_ROLE) where

- _nftDescriptorAddress
- — is the address ofNFTDescriptor
- contract,
- which must support theINFTDescriptor
- interface:

interface

INFTDescriptor

{ function

constructTokenURI (uint256 _requestId)

external

view

returns

(string

memory) } note Reverts ifmsg.sender has noMANAGE_TOKEN_URI_ROLE assigned.[Edit this page](#) [Previous](#)
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