

# **SQL Server Docker Setup Guide w/Database Restore ver. 1.0**

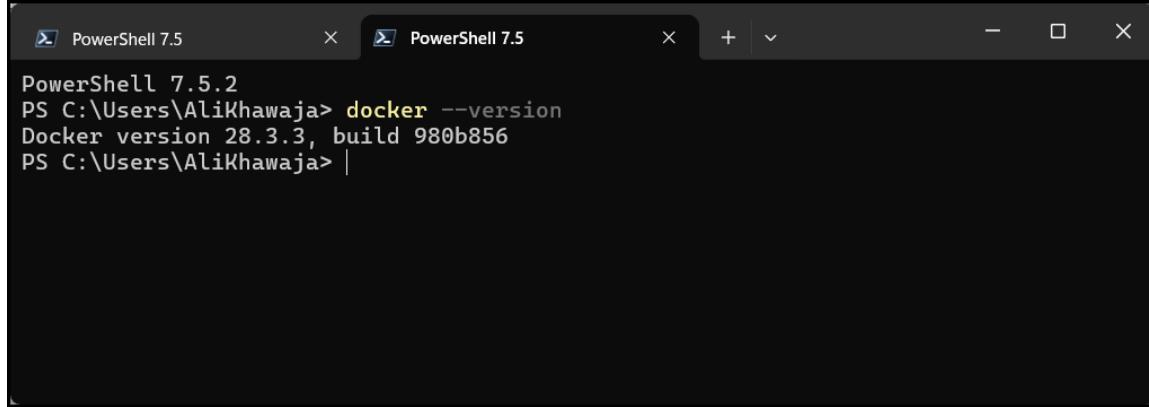
## **Abstract**

This document provides detail steps to run SQL Server in a container and restore database backup

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## Step 1: Install Docker Desktop

- Download Docker Desktop from <https://www.docker.com/products/docker-desktop/>
- Install and launch Docker.
- Verify installation by running `docker --version` in Terminal.

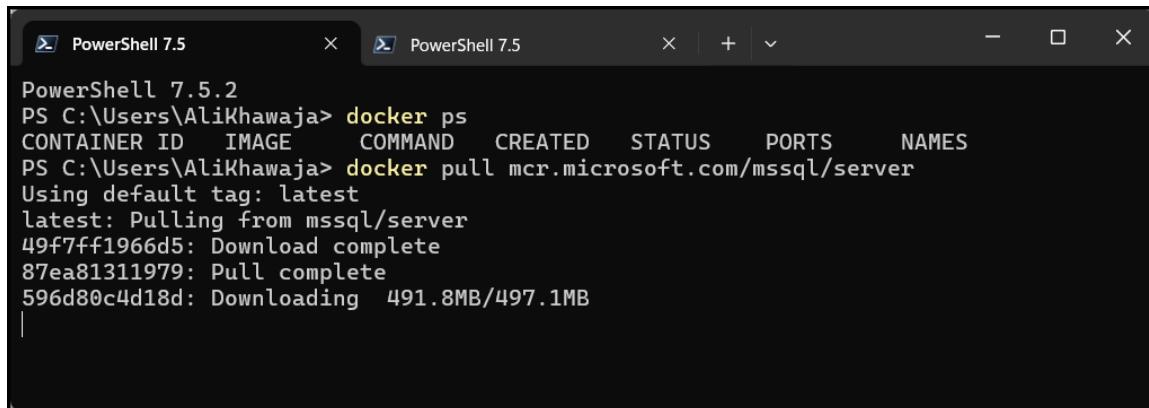


```
PowerShell 7.5.2
PS C:\Users\AliKhawaja> docker --version
Docker version 28.3.3, build 980b856
PS C:\Users\AliKhawaja> |
```

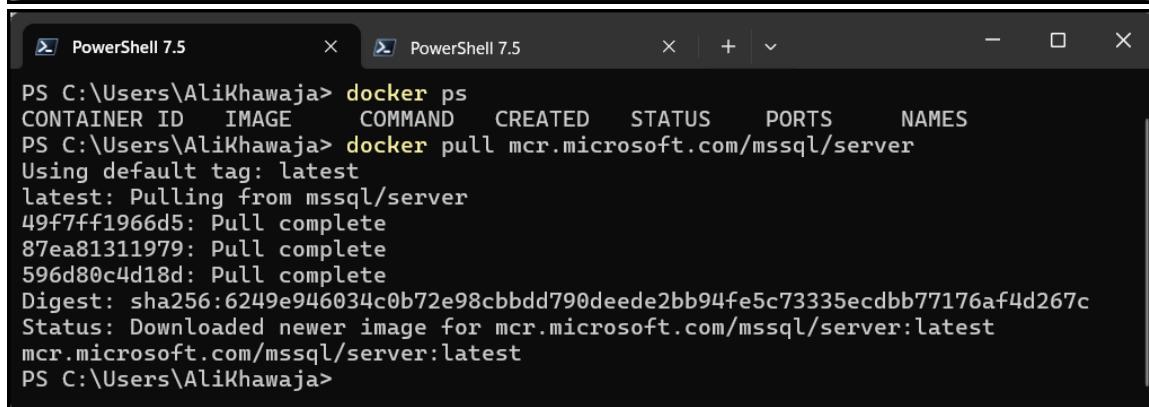
Figure 1: Verifying docker installation in Windows Terminal

## Step 2: Pull the SQL Server Image

- Run `docker pull mcr.microsoft.com/mssql/server` to download the official SQL Server image.



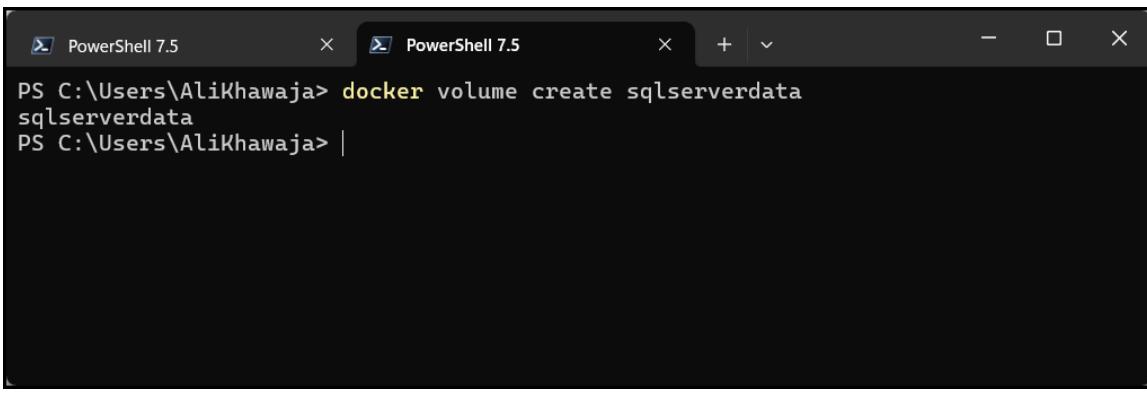
```
PowerShell 7.5.2
PS C:\Users\AliKhawaja> docker ps
CONTAINER ID   IMAGE      COMMAND   CREATED     STATUS      PORTS      NAMES
PS C:\Users\AliKhawaja> docker pull mcr.microsoft.com/mssql/server
Using default tag: latest
latest: Pulling from mssql/server
49f7ff1966d5: Download complete
87ea81311979: Pull complete
596d80c4d18d: Downloading 491.8MB/497.1MB
```



```
PowerShell 7.5.2
PS C:\Users\AliKhawaja> docker ps
CONTAINER ID   IMAGE      COMMAND   CREATED     STATUS      PORTS      NAMES
PS C:\Users\AliKhawaja> docker pull mcr.microsoft.com/mssql/server
Using default tag: latest
latest: Pulling from mssql/server
49f7ff1966d5: Pull complete
87ea81311979: Pull complete
596d80c4d18d: Pull complete
Digest: sha256:6249e946034c0b72e98cbbdd790deede2bb94fe5c73335ecdbb77176af4d267c
Status: Downloaded newer image for mcr.microsoft.com/mssql/server:latest
mcr.microsoft.com/mssql/server:latest
PS C:\Users\AliKhawaja>
```

## Step 3: Create a Docker Volume

- Run `docker volume create sqlserverdata` to create a persistent volume.



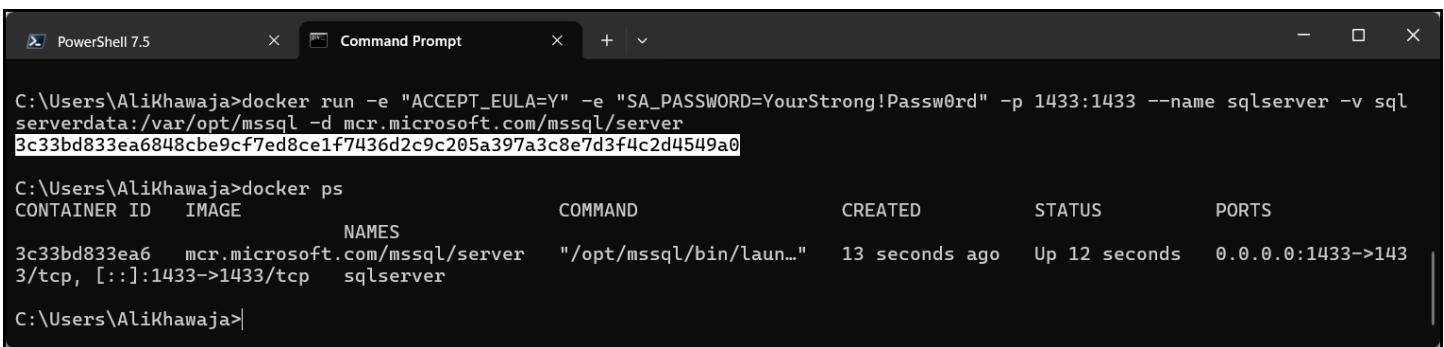
```
PS C:\Users\AliKhawaja> docker volume create sqlserverdata
sqlserverdata
PS C:\Users\AliKhawaja> |
```

- We'll use this volume to store SQL Server data since we contains are stateless and cannot store data.
  - Volumes ensures data persistence across container restarts.
  - Volumes keeps database files isolated from container lifecycle.
  - Volumes allows reuse of data across multiple containers.

## Step 4: Run SQL Server Container with Volume

Run the following command, which starts SQL Server with a volume mounted for data persistence.

```
docker run -e "ACCEPT_EULA=Y" -e "SA_PASSWORD=YourStrong!Passw0rd" -p 1433:1433 --name sqlserver -v sqlserverdata:/var/opt/mssql -d mcr.microsoft.com/mssql/server
```



```
C:\Users\AliKhawaja>docker run -e "ACCEPT_EULA=Y" -e "SA_PASSWORD=YourStrong!Passw0rd" -p 1433:1433 --name sqlserver -v sqlserverdata:/var/opt/mssql -d mcr.microsoft.com/mssql/server
3c33bd833ea6848ce9cf7ed8ce1f7436d2c9c205a397a3c8e7d3f4c2d4549a0

C:\Users\AliKhawaja>docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED            STATUS              PORTS
3c33bd833ea6      mcr.microsoft.com/mssql/server   "/opt/mssql/bin/laun..."   13 seconds ago    Up 12 seconds   0.0.0.0:1433->143
3/tcp, [::]:1433->1433/tcp      sqlserver

C:\Users\AliKhawaja>
```

*Note: Some commands have a single hyphen (-e) and some have double hyphens (--name). When you use the abbreviated form of the parameter, e.g., (-e), it takes single hyphen, and when you provide full name e.g., (--name), then it takes two hyphens.*

## Explanation of Each Part

- **docker run:** Starts a new container.
- **-e "ACCEPT\_EULA=Y":** Accepts the SQL Server license agreement. Required to run the container.
- **-e "SA\_PASSWORD=YourStrong!Passw0rd":** Sets the password for the SA (System Administrator) account. Must meet SQL Server's complexity requirements.
- **-p 1433:1433:** Maps port 1433 on your Mac to port 1433 in the container. This allows external tools (like VS Code) to connect to SQL Server.
- **--name sqlserver:** Names the container 'sqlserver' for easy reference.
- **-v sqlserverdata:/var/opt/mssql:** Mounts a Docker volume named 'sqlserverdata' which was created in the previous step, to the SQL Server data directory. This ensures data persists even if the container is stopped or deleted.
- **-d:** Runs the container in detached mode (in the background).

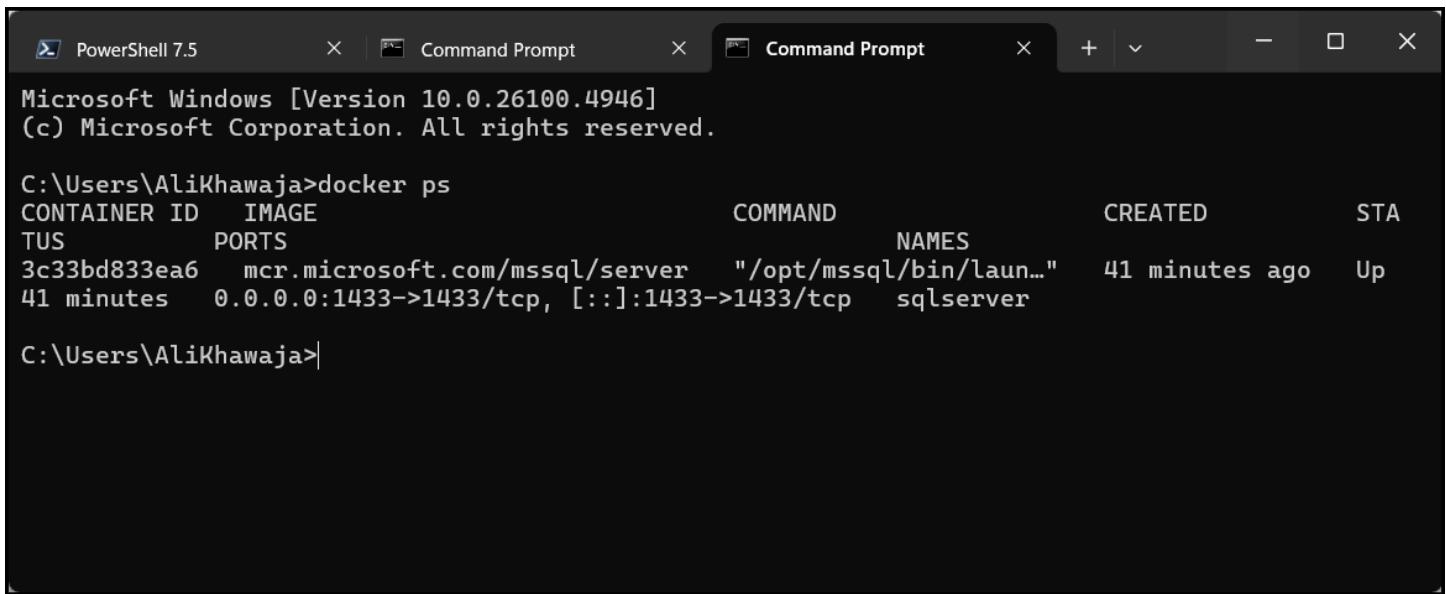
- `mcr.microsoft.com/mssql/server`: Specifies the image to use (Microsoft's official SQL Server image).

**Why Use a Volume?** Using a volume (`-v sqlserverdata:/var/opt/mssql`) is essential for data persistence:

- Without it, all data (databases, tables, etc.) is lost when the container is removed.
- Volumes store data outside the container, making it reusable and safe.
- You can stop, restart, or recreate containers without losing your work.

## Step 5: Verify Container is Running

- Run `docker ps` to confirm the container is active.



```
Microsoft Windows [Version 10.0.26100.4946]
(c) Microsoft Corporation. All rights reserved.

C:\Users\AliKhawaja>docker ps
CONTAINER ID   IMAGE               COMMAND                  CREATED        STATUS          PORTS
TUS           mcr.microsoft.com/mssql/server   "/opt/mssql/bin/laun..."   41 minutes ago   Up
41 minutes    0.0.0.0:1433->1433/tcp, [::]:1433->1433/tcp   sqlserver

C:\Users\AliKhawaja>
```

## Step 6: Install VS Code & SQL Server Extension

- Download Visual Studio Code from <https://code.visualstudio.com/>
- Open VS Code and install the '`SQL Server (mssql)`' extension from the Extensions panel.

*Note: This step is also demonstrated in a video posted on LMS under tutorials.*

## Step 7: Connect to SQL Server from VS Code

- Select the newly installed extension from the left pane of the vscode:



- Click on the + sign



- Enter the details in the **Connect to Database** Screen:

## Connect to Database

Profile Name   

Connection Group   

Input type  Parameters [Load from Connection String](#)  
  Browse Azure [Not signed in • Sign into Azure](#)

Server name \*   

Trust server certificate

Authentication type \*   

User name \*   

Password \*   

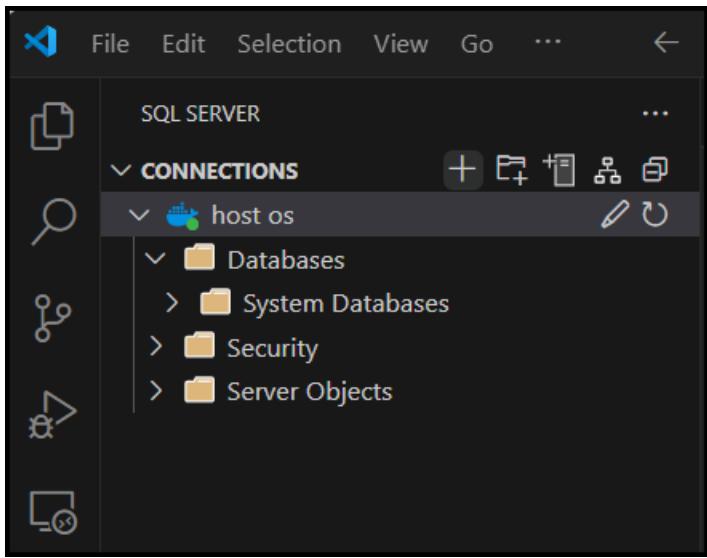
Save Password   

Database name   

Encrypt   

Advanced Connect

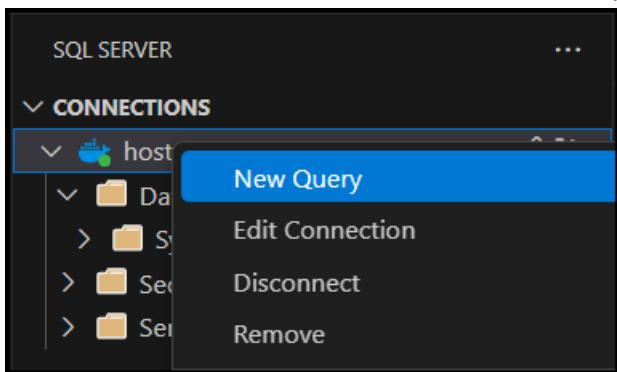
- Server name: localhost
- Authentication type: SQL Login
- Username: sa
- Password: YourStrong!Passw0rd (or whatever else you choose when starting your sql server container)
- Database name: Leave blank to connect to master



The blue docker icon shows that vscode understands that it has made connection to a sql server running as a container

## Step 8: Test with a Simple Query

- Write click on the host os and select New Query



Save the new file with `.sql` extension (this will allow vscode to help you code completions for SQL Language)

The screenshot shows the Visual Studio Code interface with a dark theme. On the left is the sidebar with icons for file, search, connections, and query history. The main area has a title bar with 'SQL SERVER' and a search bar. Below the title bar is a 'CONNECTIONS' section showing a connection to 'localhost | master'. A query editor window is open with the command 'select @@VERSION'. The results pane below shows the output of the query:

	(No column name)
1	Microsoft SQL Server 2022 (RTM-CU20-GDR) (KB506381...

## Step 9: Restore the AdventureWorks2022 Database

### Step 1: Download the Backup File

Download the AdventureWorks2022.bak file from the official Microsoft website or GitHub repository.

### Step 2: Copy the Backup File into the Container

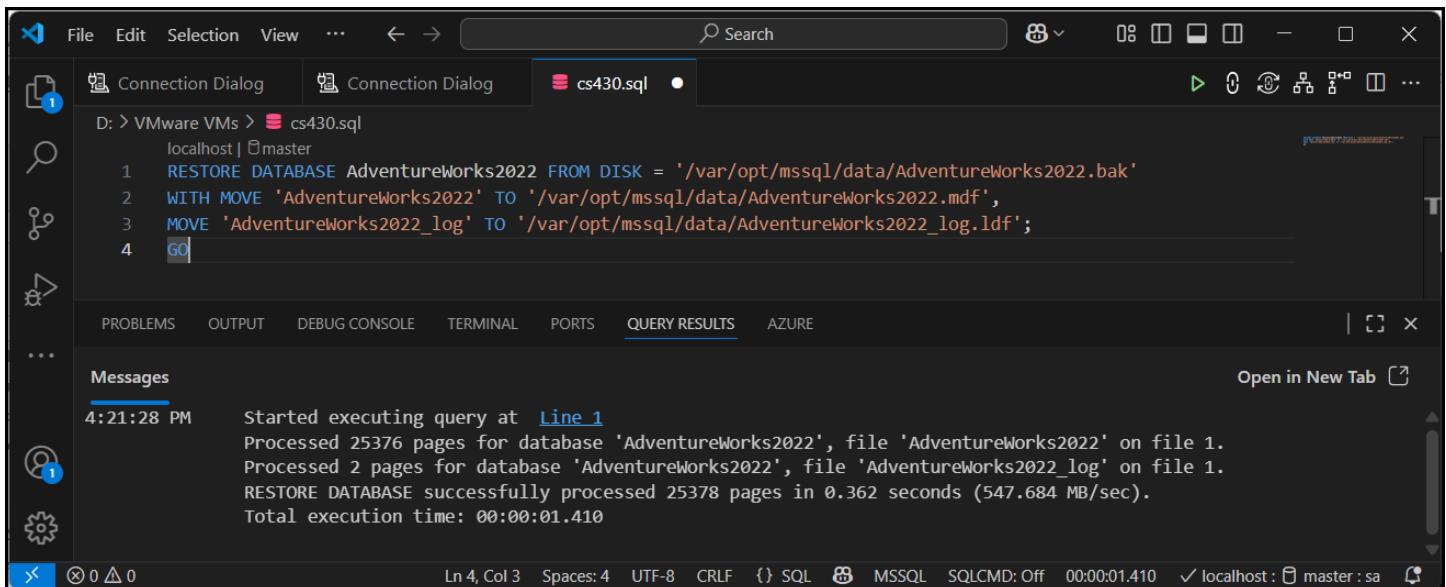
Use the docker `cp` command to copy the .bak file into the SQL Server container's storage volume. This will allow file to be saved in volume and will always be available whenever you stop and restart sql server:

```
docker cp AdventureWorks2022.bak sqlserver:/var/opt/mssql/data
```

### Step 4: Restore the Database

Run the following SQL command from your VSCode connection to restore the database:

```
RESTORE DATABASE AdventureWorks2022 FROM DISK =
'/var/opt/mssql/data/AdventureWorks2022.bak'
WITH MOVE 'AdventureWorks2022' TO '/var/opt/mssql/data/AdventureWorks2022.mdf',
MOVE 'AdventureWorks2022_log' TO
'/var/opt/mssql/data/AdventureWorks2022_log.ldf';
```



```
D: > VMware VMs > cs430.sql
localhost | master
1 RESTORE DATABASE AdventureWorks2022 FROM DISK = '/var/opt/mssql/data/AdventureWorks2022.bak'
2 WITH MOVE 'AdventureWorks2022' TO '/var/opt/mssql/data/AdventureWorks2022.mdf',
3 MOVE 'AdventureWorks2022_log' TO '/var/opt/mssql/data/AdventureWorks2022_log.ldf';
4 GO
```

PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL PORTS QUERY RESULTS AZURE

Messages

4:21:28 PM Started executing query at Line 1  
Processed 25376 pages for database 'AdventureWorks2022', file 'AdventureWorks2022' on file 1.  
Processed 2 pages for database 'AdventureWorks2022', file 'AdventureWorks2022\_log' on file 1.  
RESTORE DATABASE successfully processed 25378 pages in 0.362 seconds (547.684 MB/sec).  
Total execution time: 00:00:01.410

Ln 4, Col 3 Spaces: 4 UTF-8 CRLF {} SQL MSSQL SQLCMD: Off 00:00:01.410 ✓ localhost : master : sa

The RESTORE DATABASE command in SQL Server is used to restore a database from a backup file. Following is the detail explanation of the RESTORE command's each option as used above.

### 1. RESTORE DATABASE AdventureWorks2022

- This tells SQL Server to restore a database named AdventureWorks2022.

### 2. FROM DISK = '/var/opt/mssql/data/AdventureWorks2022.bak'

- Specifies the path to the backup file (.bak) inside the container.

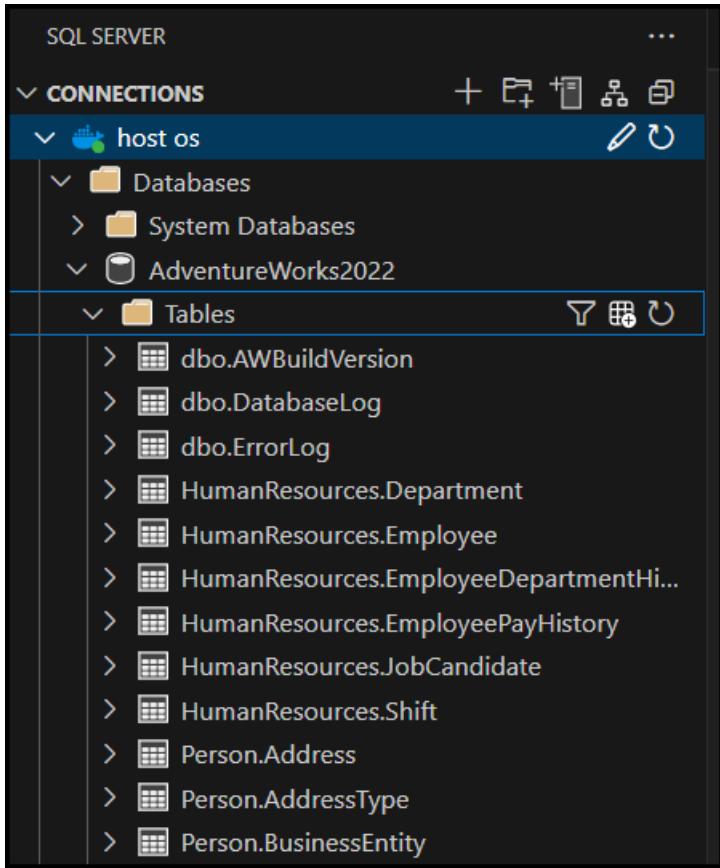
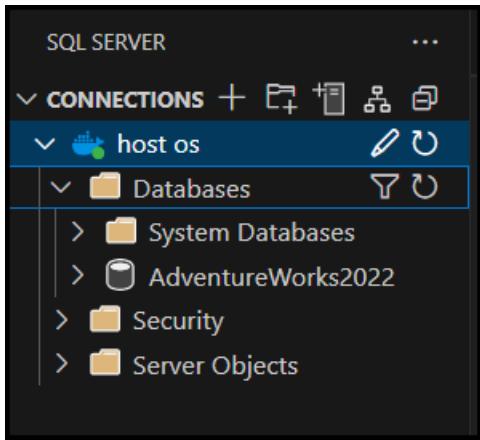
### 3. WITH MOVE

- This clause is **essential** when the original database was backed up from a system with different file paths.
  - It **redirects** the logical file names in the backup to physical file paths on your current system.
- ◆ **MOVE 'AdventureWorks2022' TO '/var/opt/mssql/data/AdventureWorks2022.mdf'**
- The path '**/var/opt/mssql/data/AdventureWorks2022.mdf**' is where the **data file** will be restored in your container.
- ◆ **MOVE 'AdventureWorks2022\_log' TO  
'/var/opt/mssql/data/AdventureWorks2022\_log.ldf'**
- The path '**/var/opt/mssql/data/AdventureWorks2022\_log.ldf**' is where the **log file** will be restored.

*Note: SQL Server database is composed of at least two file types: data file, and log file. Data file has .mdf extension, and log file has .ldf extension.*

### Step 5: Verify the Restoration

Refresh your vscode sql server pane to see the database successfully restored:



## Appendix

[Docker: Run Containers for SQL Server on Linux - SQL Server | Microsoft Learn](#)