Part 5: Test Azure SQL Database CI/CD with Azure DevOps

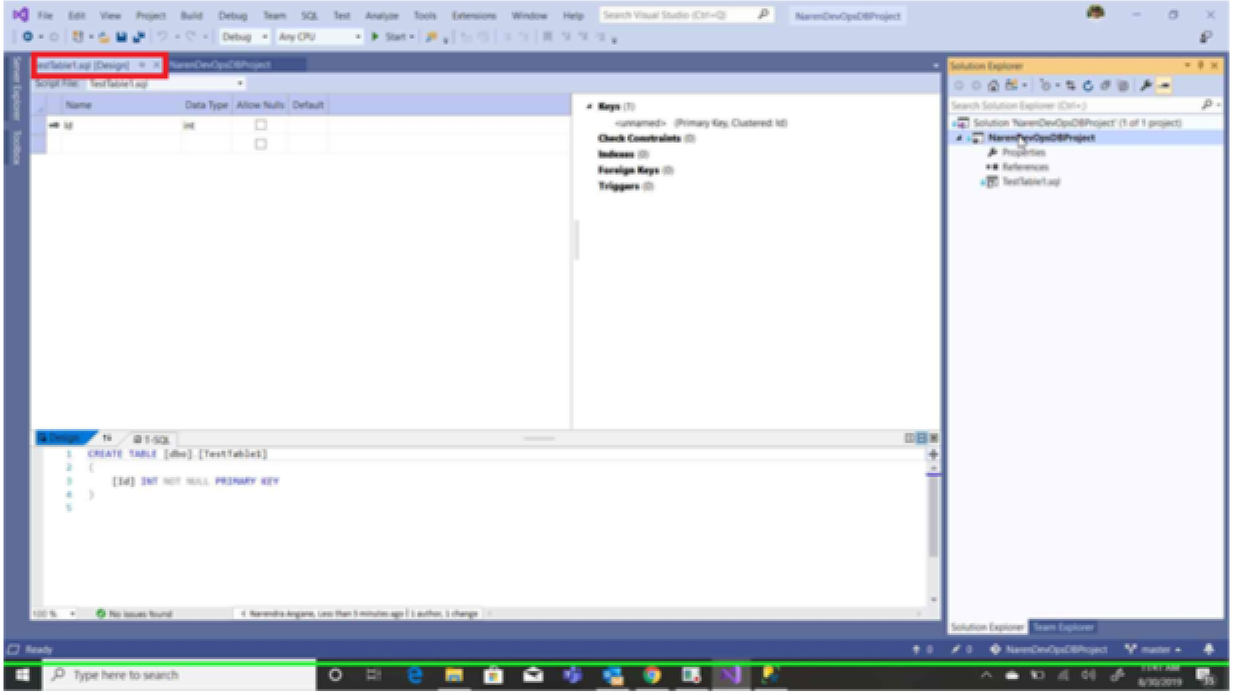
Next step is to add another table and modify existing table thru DB Project and Deploy the updated schema using CI/CD on Azure SQL Database. Let's start step by step:

We can perform 2 CI/CD test cases:

1) On targeted Azure SQL Database Add few records in TestTable1 and add New Table TestTable2 in Database Project. Sync the schema from the Database Project using CI/CD Pipeline. Will check all the objects are created every time or only new objects get created.
2) Modify Table TestTable1 schema in Database Project and sync with Azure SQL Database using CI/CD pipeline. Will check is testtable1 drop and recreate or it will perform alter operation without dropping the table.

Test Case 1:

Step1: Open Database Project created before in Visual Studio and open the TestTable1.sql

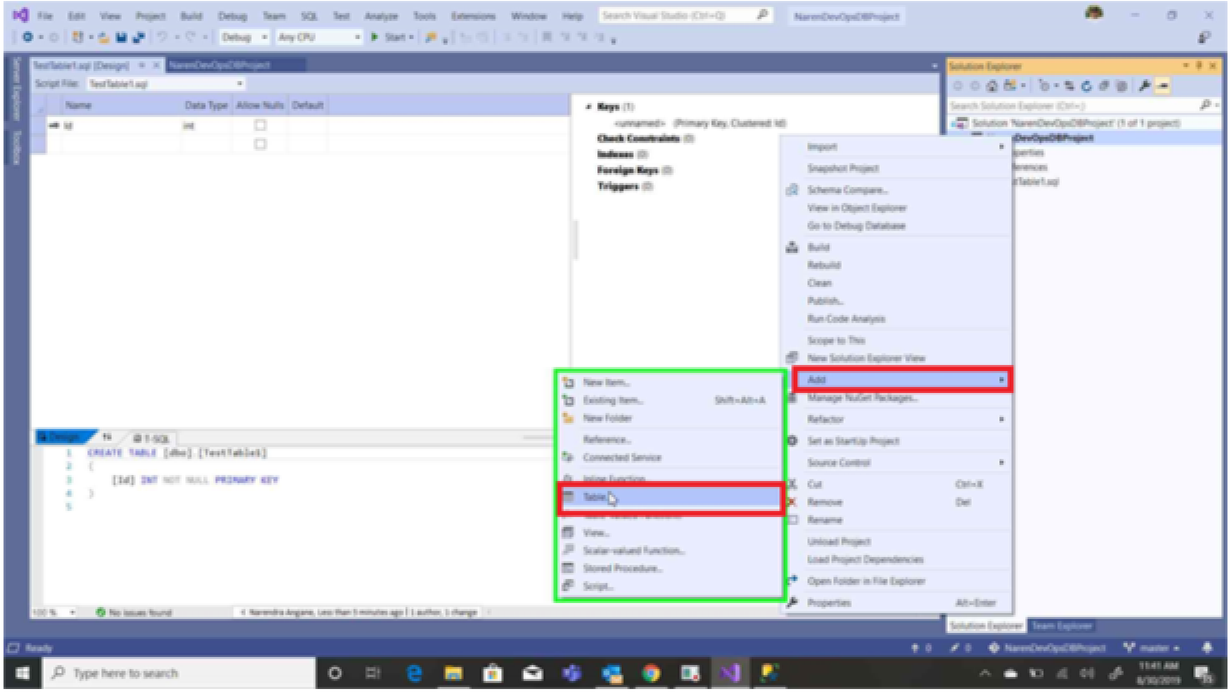


Name	Data Type	Allow Nulls	Default
Id	int	□	
		□	

- Keys (1)
  - <unnamed> (Primary Key, Clustered: Id)
- Check Constraints (0)
- Indexes (0)
- Foreign Keys (0)
- Triggers (0)

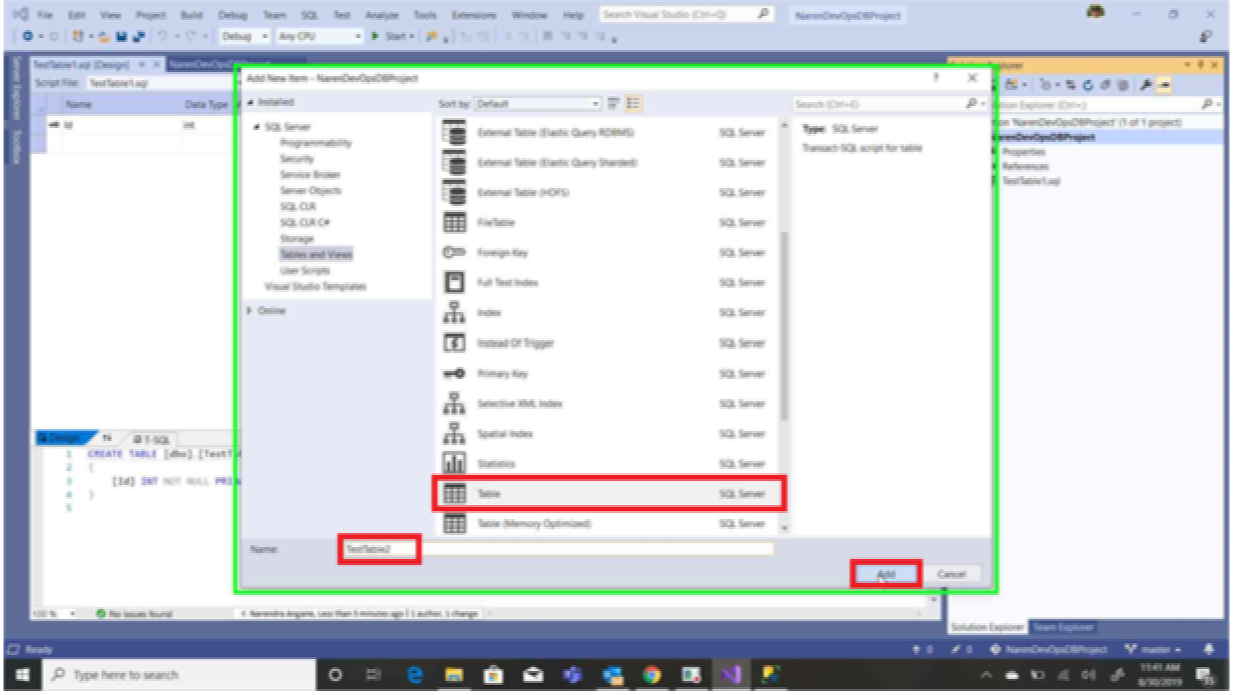
```sql
CREATE TABLE [dbo].[TestTable1]
(
    [Id] INT NOT NULL PRIMARY KEY
)
```

Step 2: From solution explorer right click on project -> Add -> Table



```
CREATE TABLE [dbo].[TestTable1]
(
    [Id] INT NOT NULL PRIMARY KEY
)
```

Step 3: In Add new item window provide name as TestTable2 for new table and click add button to add the table in Database Project.



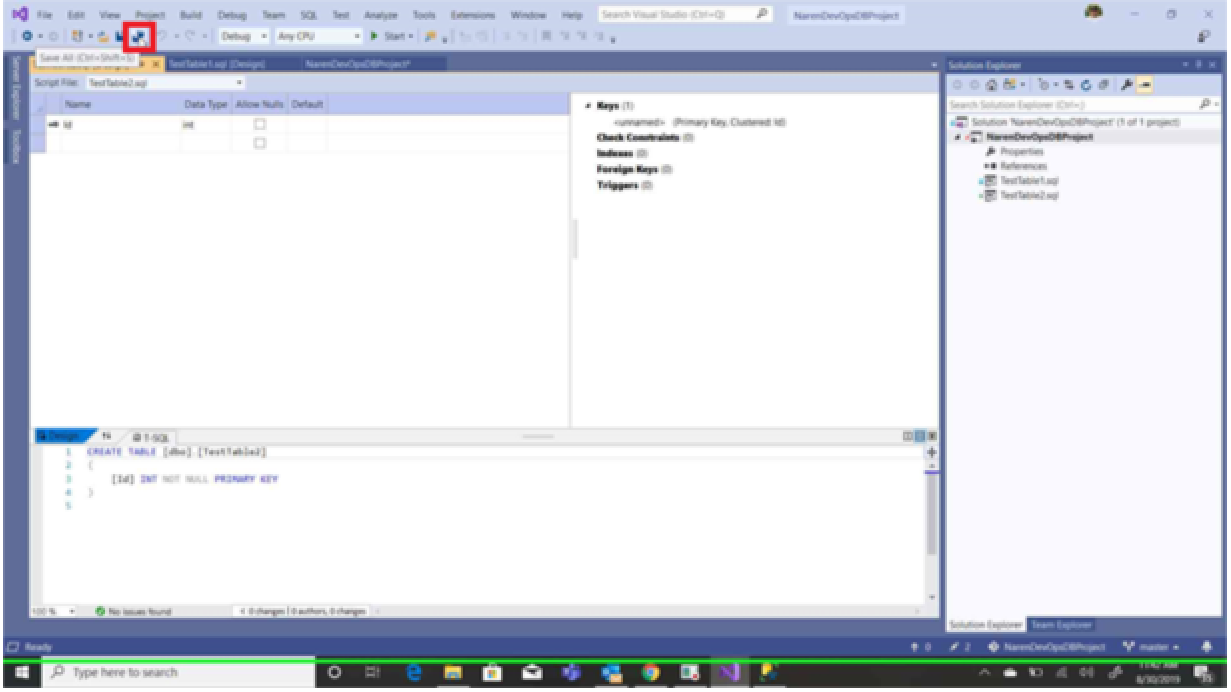
Name: TestTable2

Type: SQL Server

Transact-SQL script for table

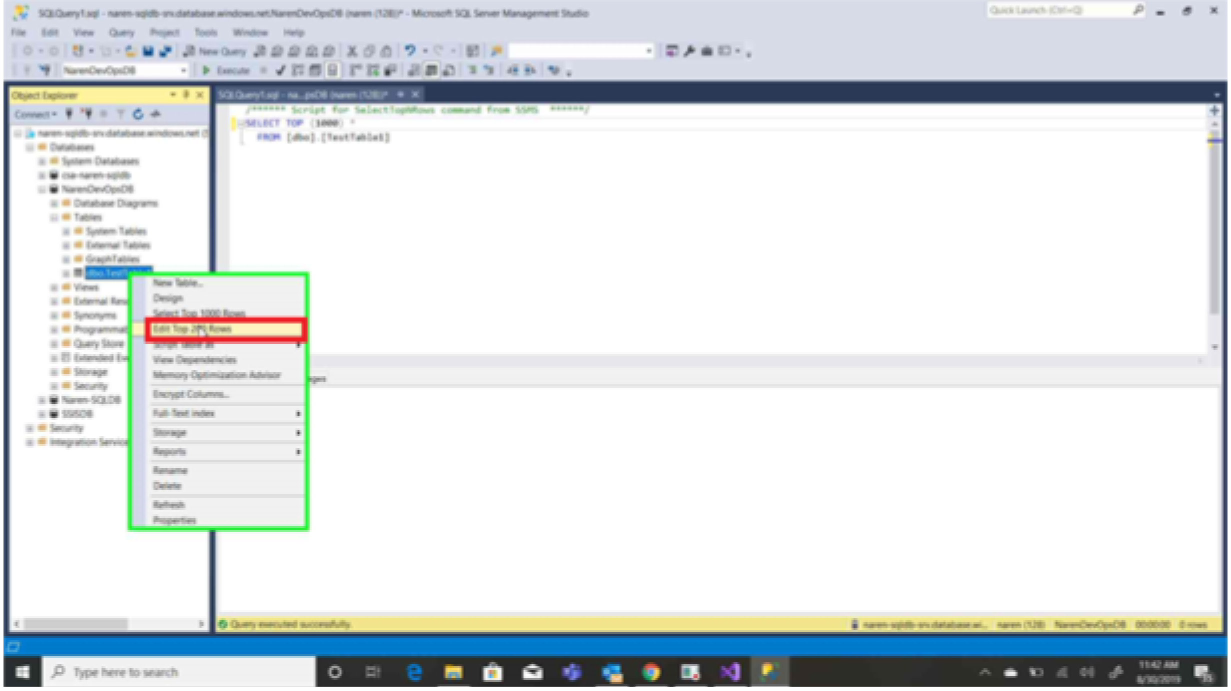
```
CREATE TABLE [dbo].[TestT
(
    [Id] INT NOT NULL PRI
)
```

Step 4: Click Sale All from the menu bar to save all the modifications



```
CREATE TABLE [dbo].[TestTable2]
(
    [Id] INT NOT NULL PRIMARY KEY
)
```

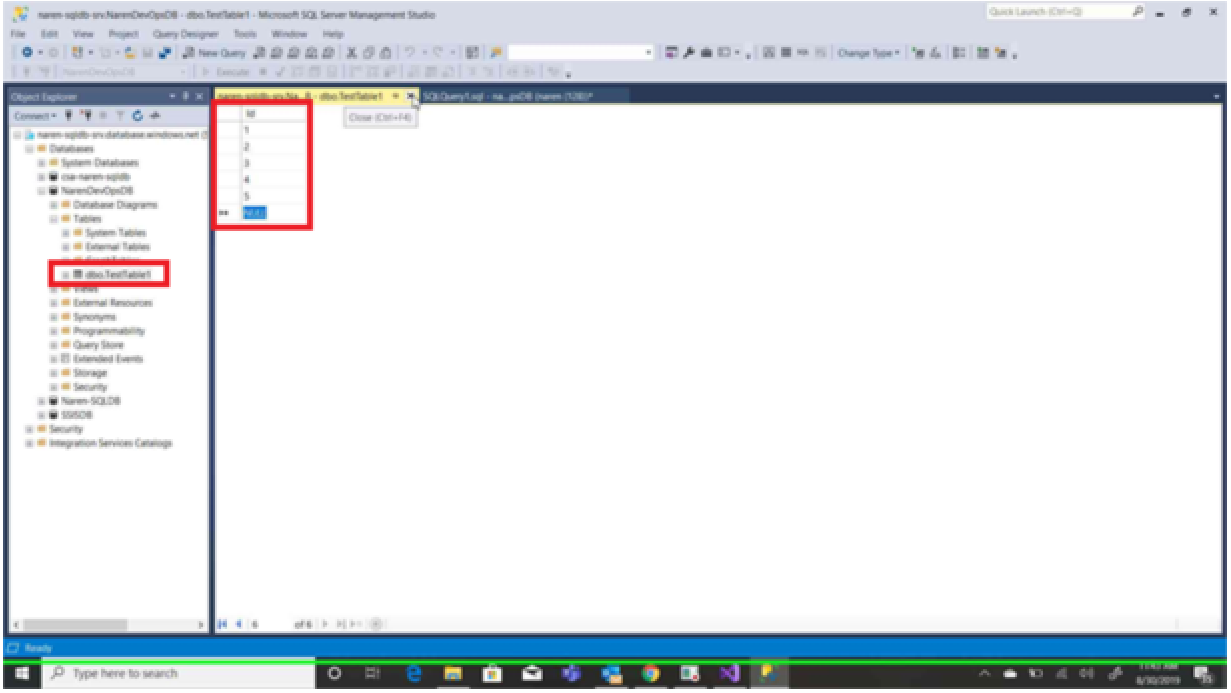
Step 5: Open SSMS and connect to the azure SQL database with proper credentials from the machine. We will add some data to the TestTable1 from the SSMS. From the object Explorer Expand SQL Server -> Databases -> [Deployed Database Name] ->Tables -> dbo.TestTable1", Right click on the table name and from the popup menu select "Edit Top 200 Rows".



```
/****** Script for SelectTopNRows command from SSMS ******/
SELECT TOP (1000) *
  FROM [dbo].[TestTable1]
```

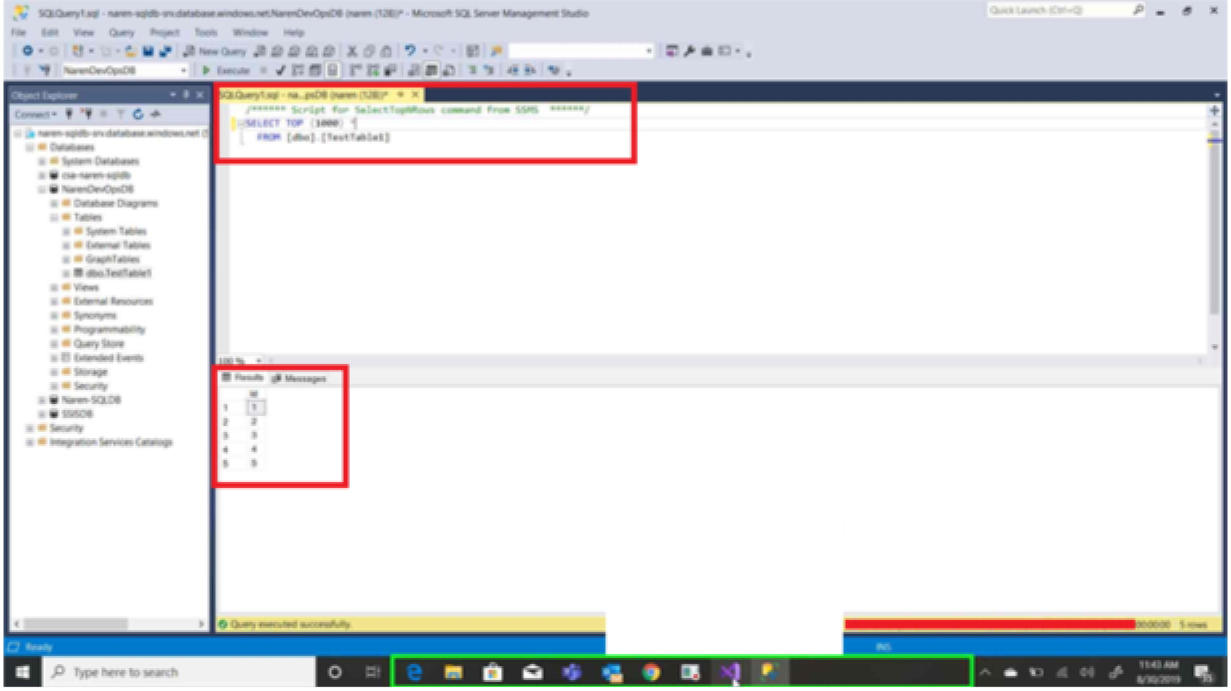
Query executed successfully.

Step 6: In the Edit Table window add 5 rows and close the window to save the data.



	Id
	1
	2
	3
	4
	5
**	NULL

Step 7: Open new query window. Make sure that you have connected to the correct database. Write the following query:
SELECT TOP (1000) * FROM [dbo].[TestTable1];
GO



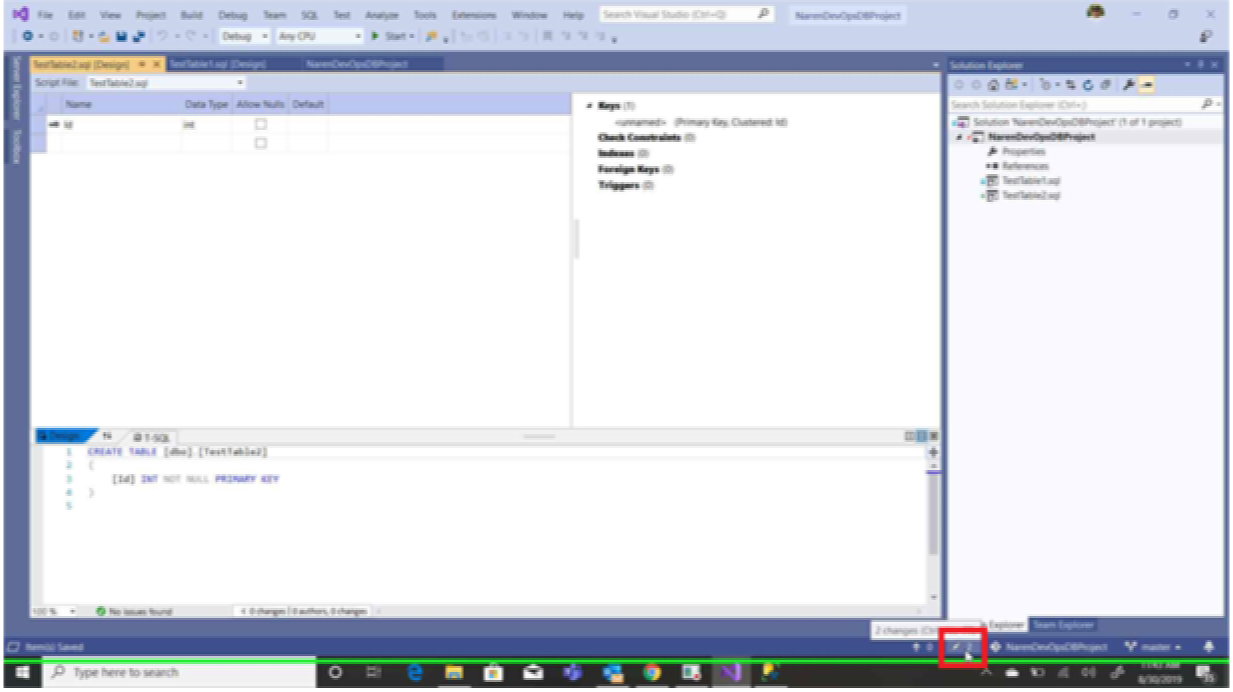
```
/****** Script for SelectTopNRows command from SSMS  ******/
SELECT TOP (1000) *
  FROM [dbo].[TestTable1]
```

	Id
1	1
2	2
3	3
4	4
5	5

Query executed successfully.

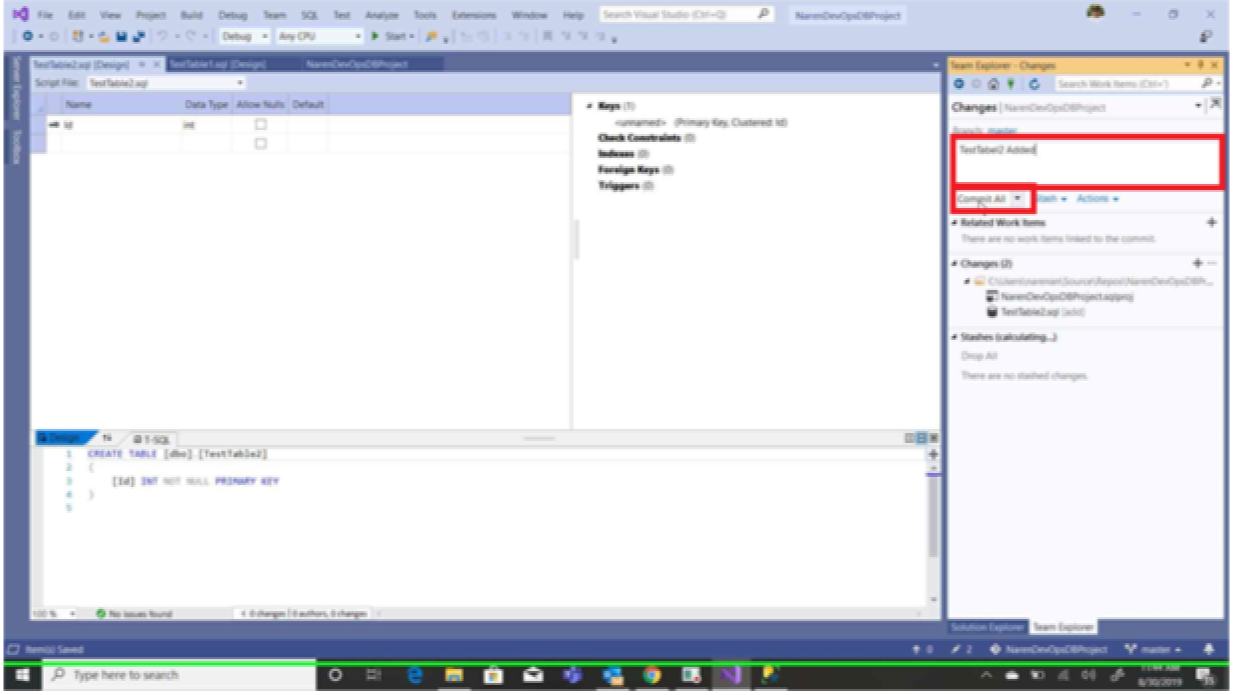
00:00:00 5 rows

Step 8: Go back to the visual studio. Click bottom at the pencil icon to commit pending changes



```
CREATE TABLE [dbo].[TestTable2]
(
    [Id] INT NOT NULL PRIMARY KEY
)
```

Step 9: Click on Team Explorer and enter comments/description as “TestTable2 Added” and click on “Commit All”.



```
CREATE TABLE [dbo].[TestTable2]
(
    [Id] INT NOT NULL PRIMARY KEY
)
```

Team Explorer - Changes

Changes | NarenDevOpsDBProject

Branch: master

TestTabel2 Added

Related Work Items

There are no work items linked to the commit.

Changes (2)

C:\Users\narenan\Source\Repos\NarenDevOpsDBPr...

NarenDevOpsDBProject.sqlproj

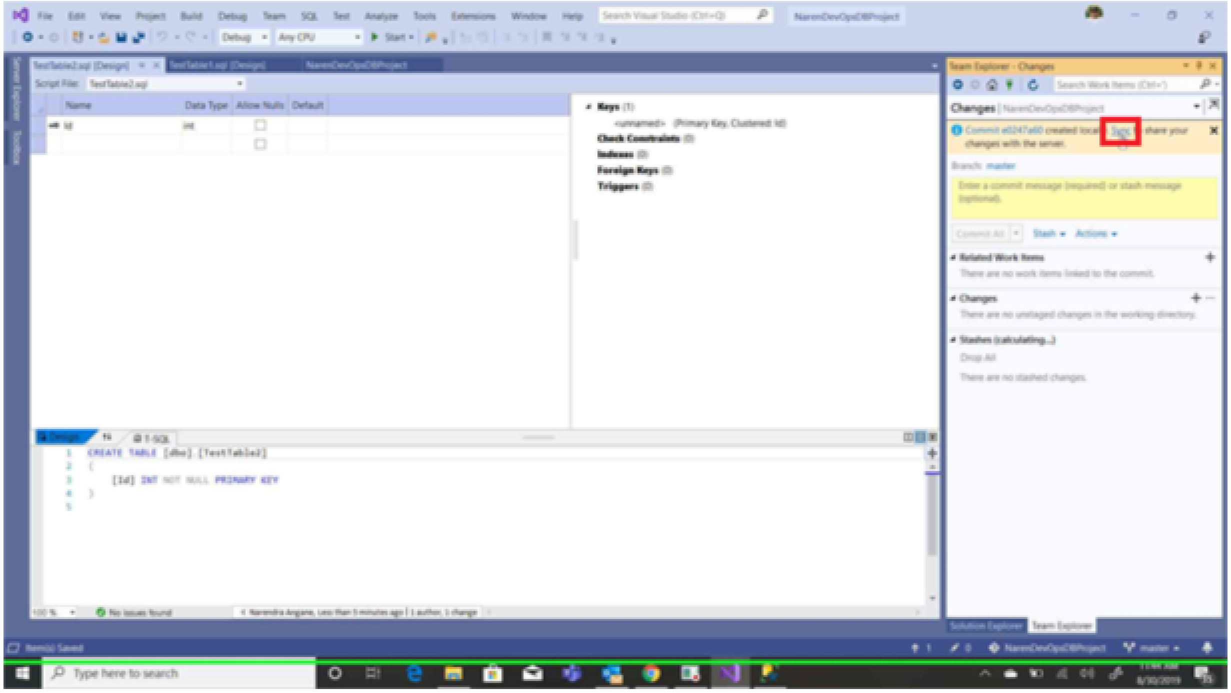
TestTable2.sql [add]

Stashes (calculating...)

Drop All

There are no stashed changes.

Step 10: In Team Explorer window click on sync hyperlink to sync your locally committed changes on the server



Team Explorer - Changes

Changes | NarenDevOpsDBProject

Commit a0247a60 created locally. Sync to share your changes with the server.

Branch: master

Enter a commit message (required) or stash message (optional).

Related Work Items

There are no work items linked to the commit.

Changes

There are no unstaged changes in the working directory.

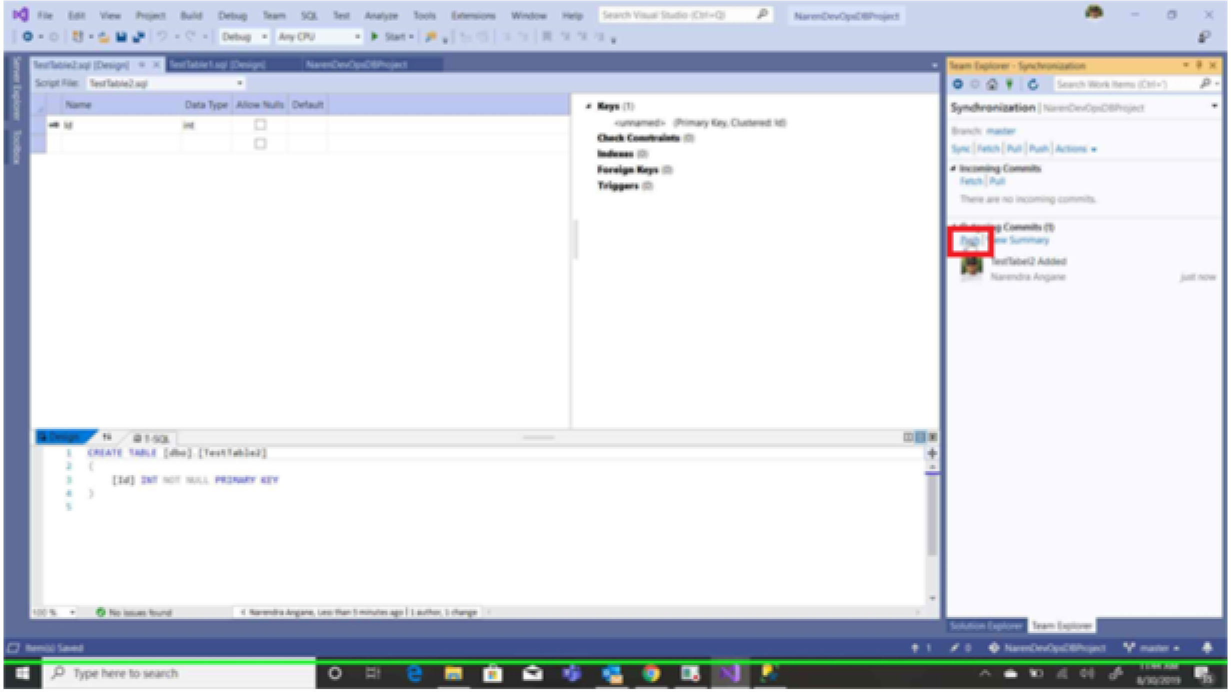
Stashes (calculating...)

Drop All

There are no stashed changes.

```
CREATE TABLE [dbo].[TestTable2]
(
    [Id] INT NOT NULL PRIMARY KEY
)
```

Step 11: In Team Explorer window click on Push hyperlink which you can found under Outgoing commit section to push the changes on the server



Team Explorer - Synchronization

Synchronization | NarenDevOpsDBProject

Branch: master

Incoming Commits

There are no incoming commits.

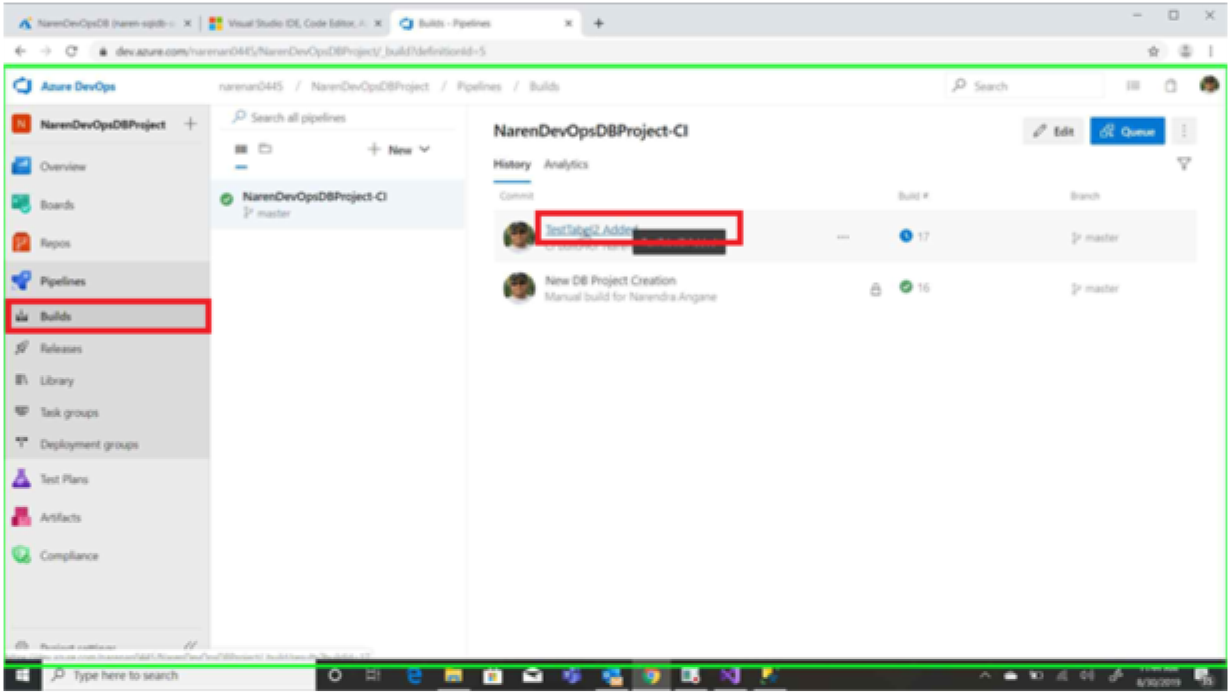
Outgoing Commits (1)

TestTabel2 Added

Narendra Angane just now

```
CREATE TABLE [dbo].[TestTable2]
(
    [Id] INT NOT NULL PRIMARY KEY
)
```

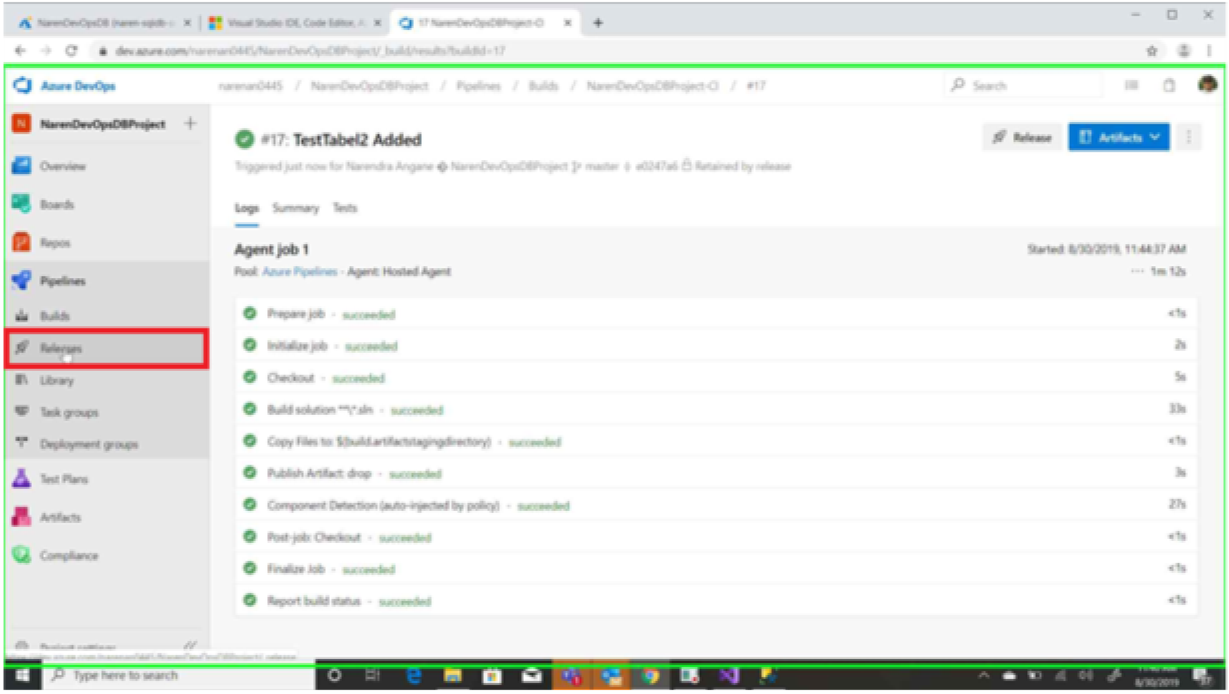
Step 12: If Azure DevOps already open then go to the Azure DevOps page in the browser else Open any browser and enter https://app.vssps.visualstudio.com/. Logged in with the proper credentials and select the DevOps project crated in our previous step. Click on Build from the left side blade to see the progress of the build pipeline. You will see that newly added table changes are reflected on this page. Click on “TestTable2 Added” hyperlink to see the progress of the build pipeline. You will observe that the build pipeline is already stated without any manual activity. Do you remember the Trigger option we have set while building the Build Pipeline? (Refer the build pipeline section for more detail)



NarenDevOpsDBProject-CI

Commit	Build #	Branch
TestTabel2 Added	17	master
New DB Project Creation Manual build for Narendra Angane	16	master

Step 13: You will see that build pipeline is successfully completed. Now you can see the progress of release pipeline by clicking on release from the left blade



#17: TestTabel2 Added

Triggered just now for Narendra Angane NarenDevOpsDBProject master e0247a6 Retained by release

Agent job 1

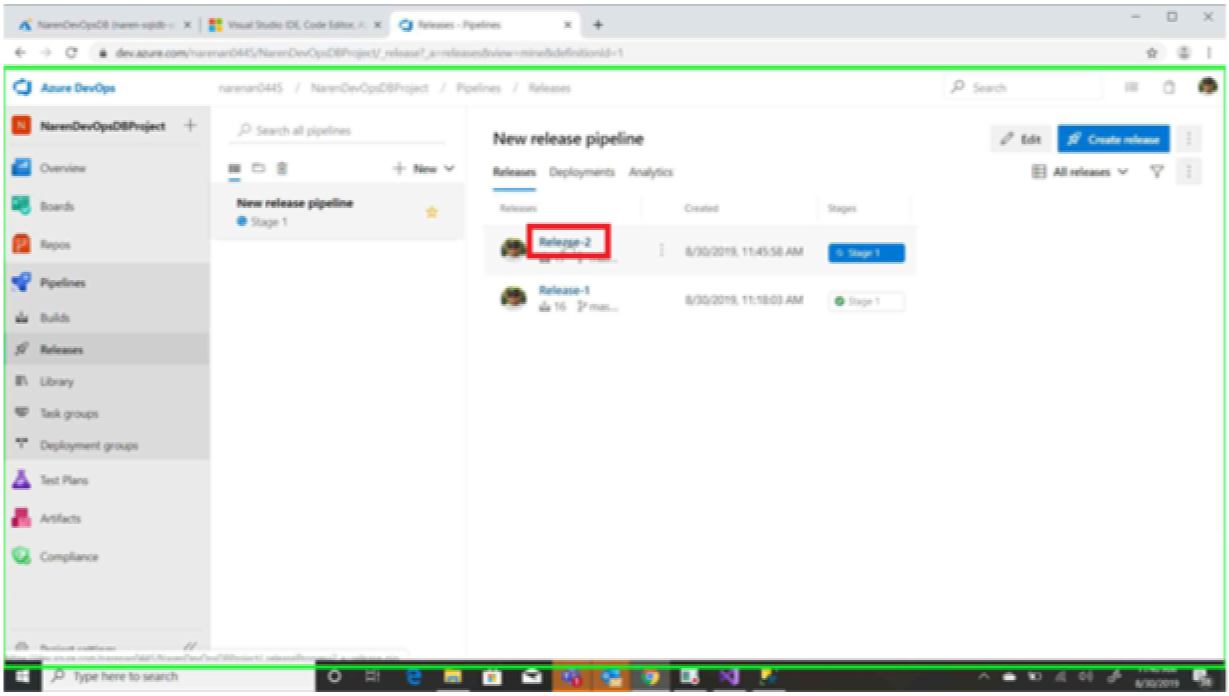
Pool: Azure Pipelines · Agent: Hosted Agent

Started: 8/30/2019, 11:44:37 AM

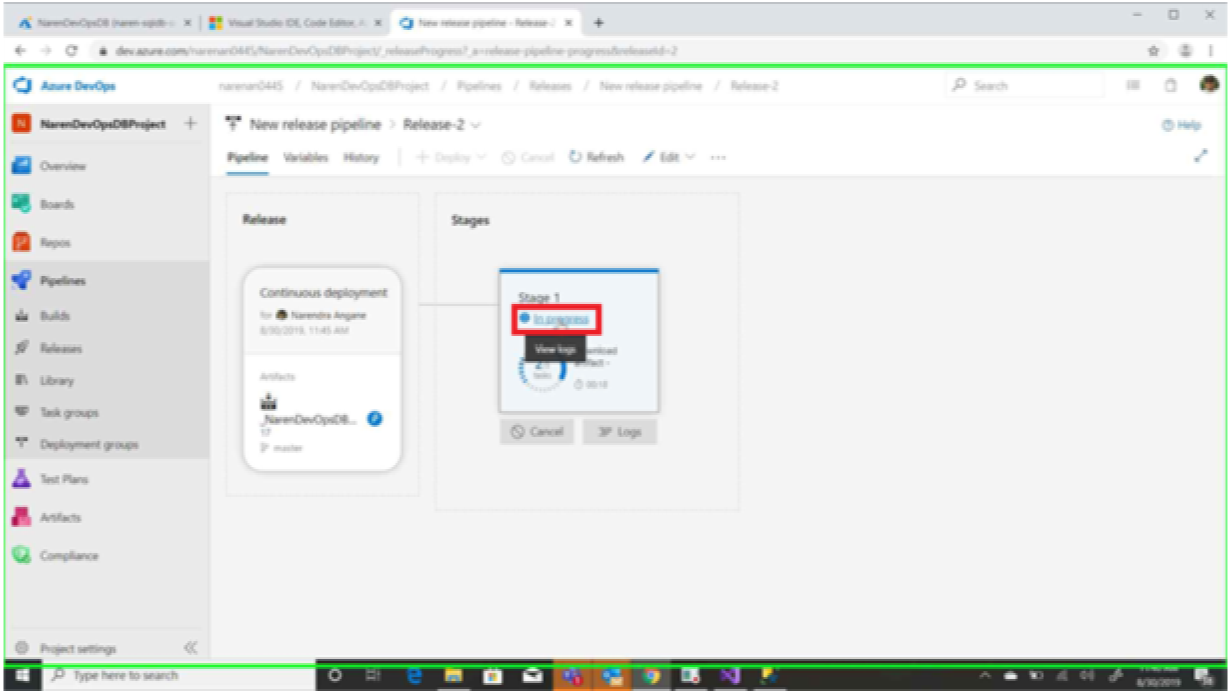
1m 12s

```
Prepare job · succeeded                                         <1s
Initialize job · succeeded                                       2s
Checkout · succeeded                                             5s
Build solution **\*.sln · succeeded                             33s
Copy Files to: $(build.artifactstagingdirectory) · succeeded    <1s
Publish Artifact: drop · succeeded                               3s
Component Detection (auto-injected by policy) · succeeded       27s
Post-job: Checkout · succeeded                                  <1s
Finalize Job · succeeded                                        <1s
Report build status · succeeded                                 <1s
```

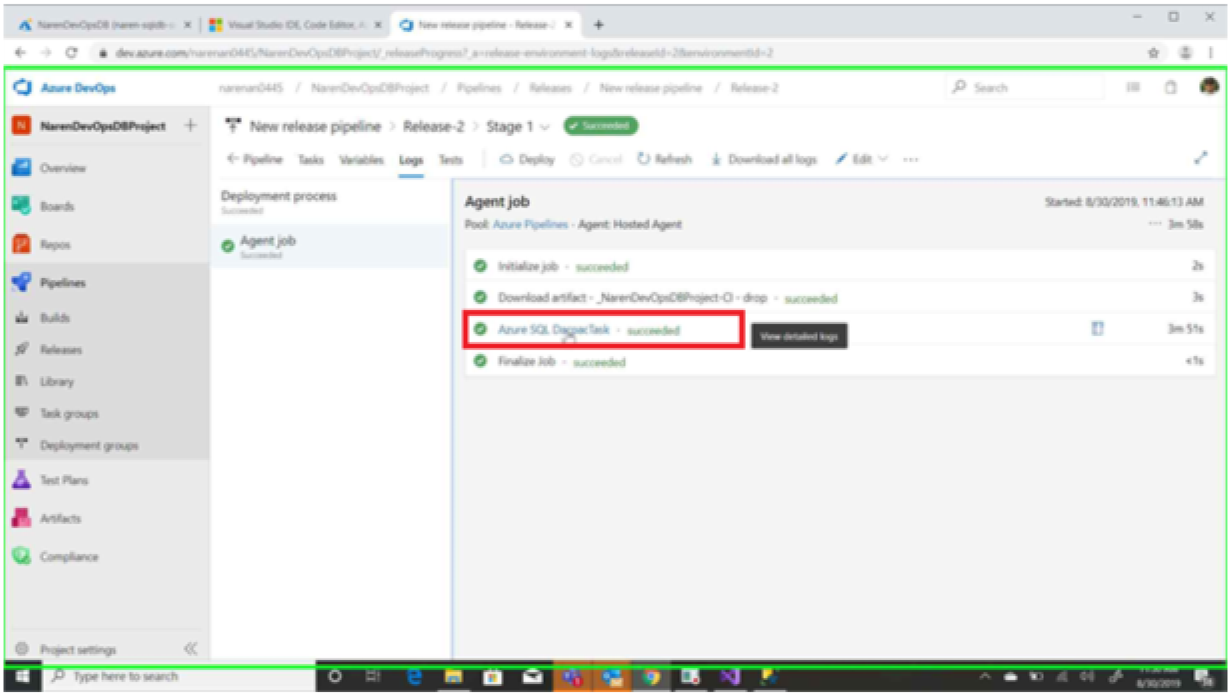
Step 14: It will open the release pipeline blade where you can see the “Release 2” is running. To see the detail of “Release 2” you can click on “Release 2” hyperlink



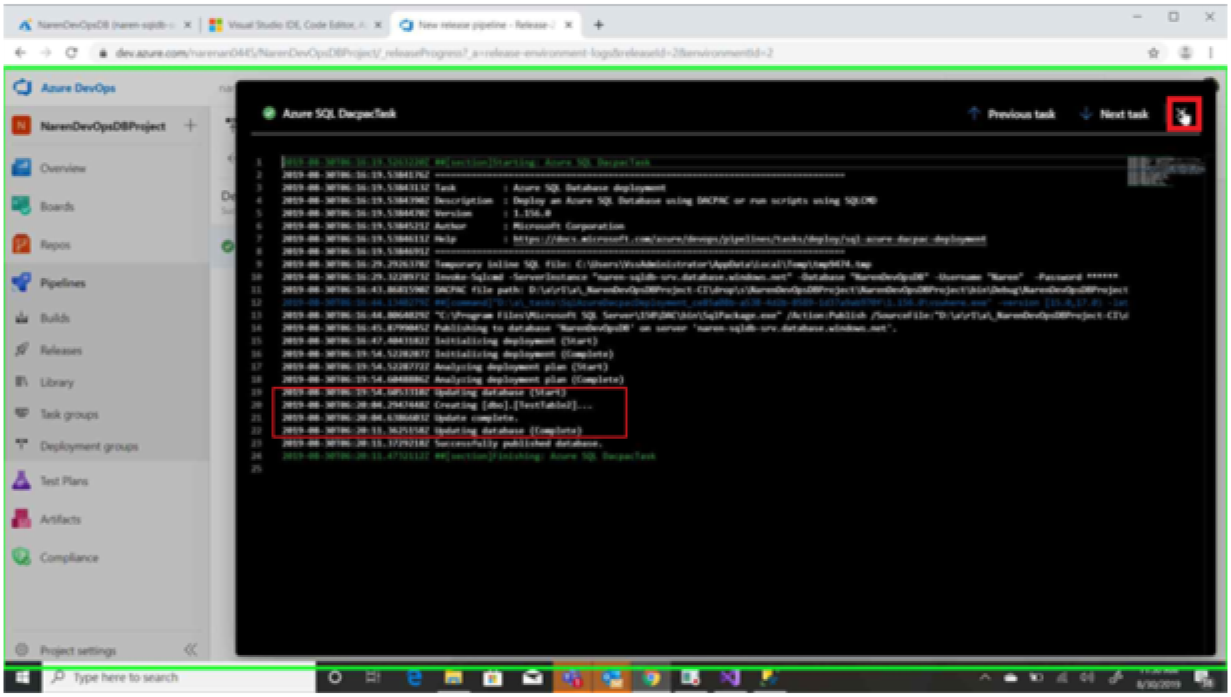
Step 15: On the "Release 2" blade click on "In progress" hyperlink which you can find it in stage1 windows



Step 16: After completion of "Release 2" pipeline you can see the similar window as follow. To find out what activities were executed in "Azure SQL DACPAC Task" click on that.

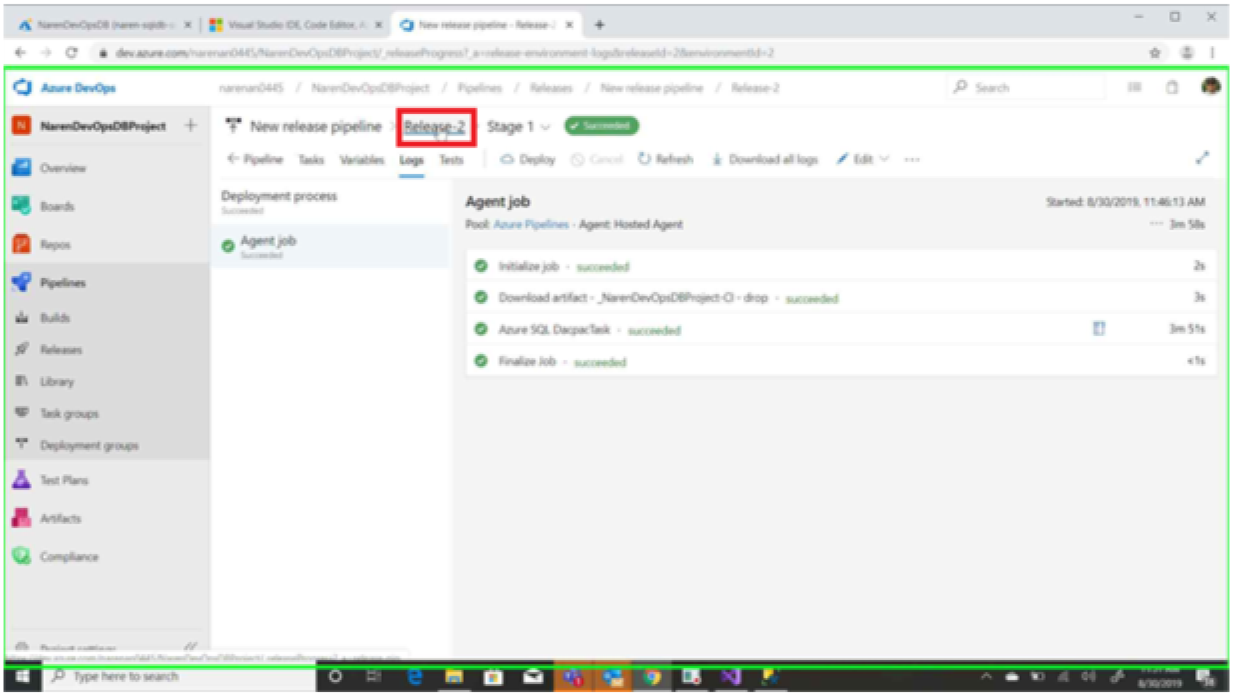

Azure DevOps
narenan0445 / NarenDevOpsDBProject / Pipelines / Releases / New release pipeline / Release-2
NarenDevOpsDBProject
New release pipeline > Release-2 > Stage 1
Succeeded
Pipeline Tasks Variables Logs Tests
Deploy Cancel Refresh Download all logs Edit
Overview
Boards
Repos
Pipelines
Builds
Releases
Library
Task groups
Deployment groups
Test Plans
Artifacts
Compliance
Project settings
Deployment process
Succeeded
Agent job
Succeeded
Agent job
Pool: Azure Pipelines · Agent: Hosted Agent
Started: 8/30/2019, 11:46:13 AM
3m 58s
Initialize job · succeeded
2s
Download artifact - _NarenDevOpsDBProject-CI - drop · succeeded
3s
Azure SQL DacpacTask · succeeded
View detailed logs
3m 51s
Finalize Job · succeeded
<1s
Type here to search

Step 17: In this window you will see that creation of TestTable2 task, but nothing related to TestTable1. It always compares the script with targeted SQL Database and execute only delta. In this case you have noticed that TestTable1 was already available on targeted and there was no changed at schema level… so no code where executed related to the TestTable1. Close the window to move next.



```
2019-08-30T06:16:19.5263228Z ##[section]Starting: Azure SQL DacpacTask
2019-08-30T06:16:19.5384176Z ==============================================================================
2019-08-30T06:16:19.5384313Z Task         : Azure SQL Database deployment
2019-08-30T06:16:19.5384398Z Description  : Deploy an Azure SQL Database using DACPAC or run scripts using SQLCMD
2019-08-30T06:16:19.5384478Z Version      : 1.156.0
2019-08-30T06:16:19.5384521Z Author       : Microsoft Corporation
2019-08-30T06:16:19.5384611Z Help         : https://docs.microsoft.com/azure/devops/pipelines/tasks/deploy/sql-azure-dacpac-deployment
2019-08-30T06:16:19.5384691Z ==============================================================================
2019-08-30T06:16:29.2926378Z Temporary inline SQL file: C:\Users\VssAdministrator\AppData\Local\Temp\tmp9474.tmp
2019-08-30T06:16:29.3228973Z Invoke-Sqlcmd -ServerInstance "naren-sqldb-srv.database.windows.net" -Database "NarenDevOpsDB" -Username "Naren"  -Password ******
2019-08-30T06:16:43.8681598Z DACPAC file path: D:\a\r1\a\_NarenDevOpsDBProject-CI\drop\s\NarenDevOpsDBProject\NarenDevOpsDBProject\bin\Debug\NarenDevOpsDBProject
2019-08-30T06:16:44.1340279Z ##[command]"D:\a\_tasks\SqlAzureDacpacDeployment_ce85a08b-a538-4d2b-8589-1d37a9ab970f\1.156.0\vswhere.exe" -version [15.0,17.0) -lat
2019-08-30T06:16:44.8064029Z "C:\Program Files\Microsoft SQL Server\150\DAC\bin\SqlPackage.exe" /Action:Publish /SourceFile:"D:\a\r1\a\_NarenDevOpsDBProject-CI\d
2019-08-30T06:16:45.8799045Z Publishing to database 'NarenDevOpsDB' on server 'naren-sqldb-srv.database.windows.net'.
2019-08-30T06:16:47.4843182Z Initializing deployment (Start)
2019-08-30T06:19:54.5228287Z Initializing deployment (Complete)
2019-08-30T06:19:54.5228772Z Analyzing deployment plan (Start)
2019-08-30T06:19:54.6048886Z Analyzing deployment plan (Complete)
2019-08-30T06:19:54.6051318Z Updating database (Start)
2019-08-30T06:20:04.2947448Z Creating [dbo].[TestTable2]...
2019-08-30T06:20:04.6386403Z Update complete.
2019-08-30T06:20:11.3625158Z Updating database (Complete)
2019-08-30T06:20:11.3729218Z Successfully published database.
2019-08-30T06:20:11.4732112Z ##[section]Finishing: Azure SQL DacpacTask
```

Step 18: Click on the “Release 2” hyperlink to go back to the “Release 2” pipeline



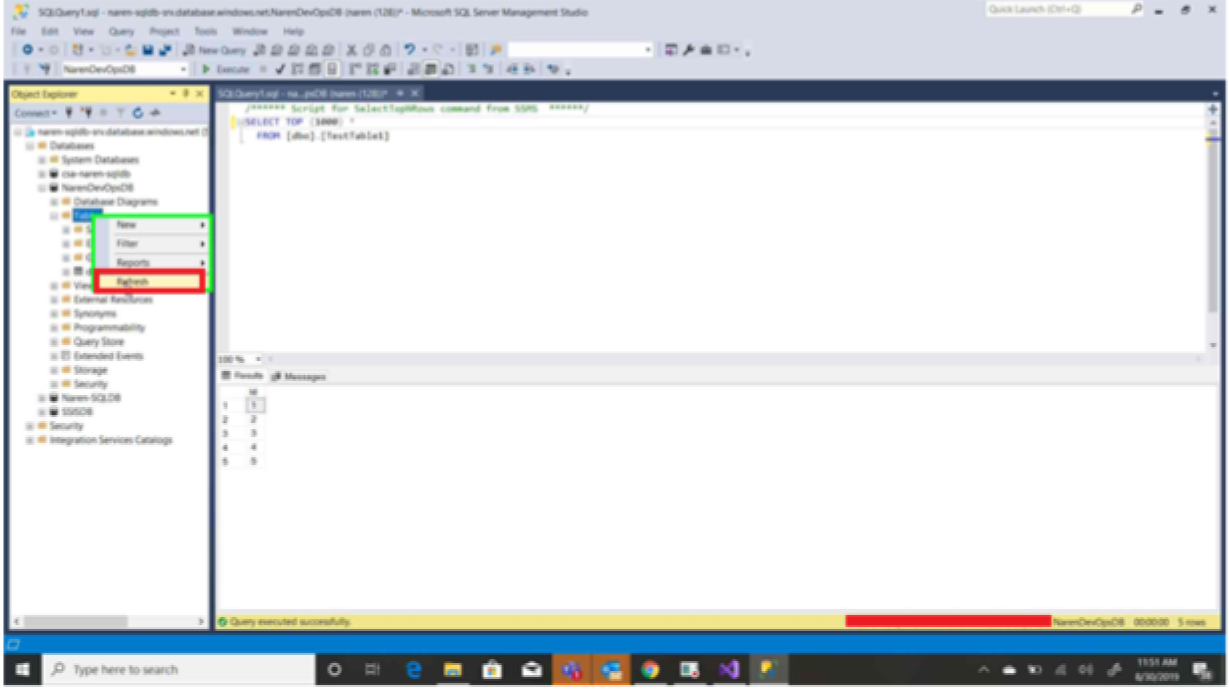
Deployment process
Succeeded

Agent job
Succeeded

Agent job
Started: 8/30/2019, 11:46:13 AM
Pool: Azure Pipelines · Agent: Hosted Agent
··· 3m 58s

```
Initialize job · succeeded                                      2s
Download artifact - _NarenDevOpsDBProject-CI - drop · succeeded 3s
Azure SQL DacpacTask · succeeded                                3m 51s
Finalize Job · succeeded                                        <1s
```

Step 19: Go to the SSMS. In object explorer Expand SQL Server -> Databases -> [Deployed Database Name] ->Tables. Right click on Tables and from the popup menu select “Refresh”

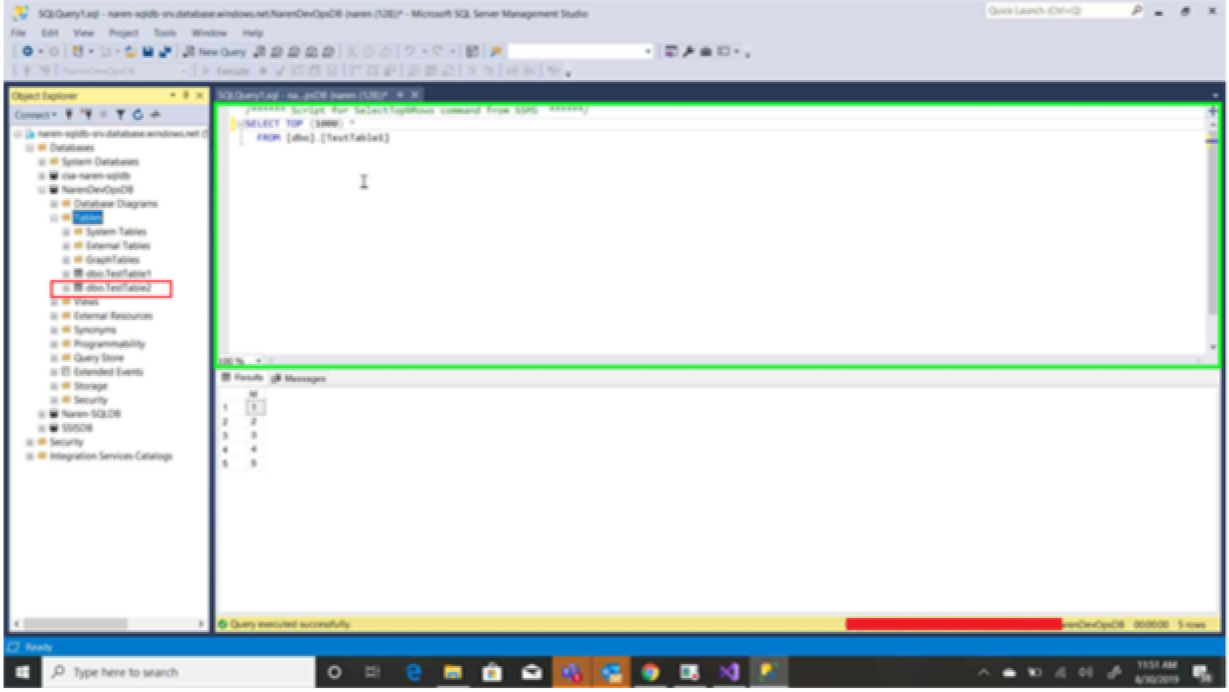


```
/****** Script for SelectTopNRows command from SSMS  ******/
SELECT TOP (1000) *
  FROM [dbo].[TestTable1]
```

	Id
1	1
2	2
3	3
4	4
5	5

Query executed successfully.

Step 20: You will see that TestTable2 is also added under tables folder.

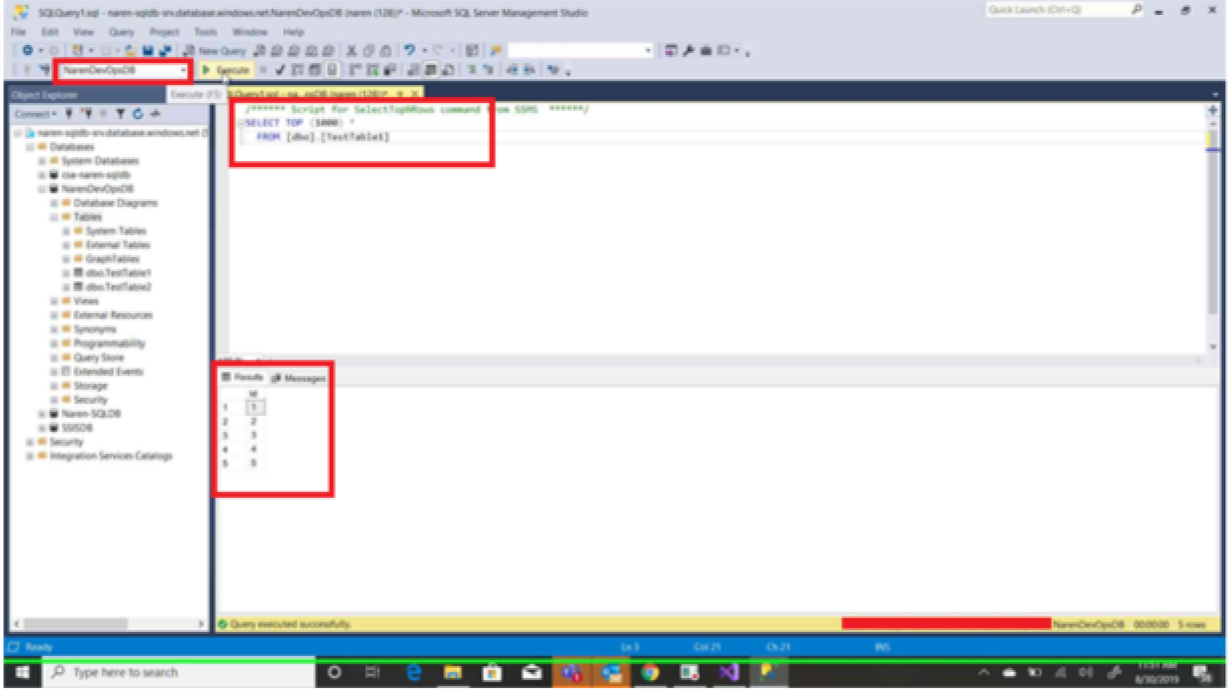


```
/****** Script for SelectTopNRows command from SSMS ******/
SELECT TOP (1000) *
  FROM [dbo].[TestTable1]
```

	Id
1	1
2	2
3	3
4	4
5	5

Query executed successfully. [redacted] NarenDevOpsDB 00:00:00 5 rows

Step 21: Run the following query on targeted database
SELECT TOP (1000) * FROM [dbo].[TestTable1];
GO
You will notice that, we still see the 5 records what we have added before. It also confirms that, every time when CICD pipeline executed it compare the BACPAC with Azure SQL Database schema and execute only delta instead of executing whole BACPAC.



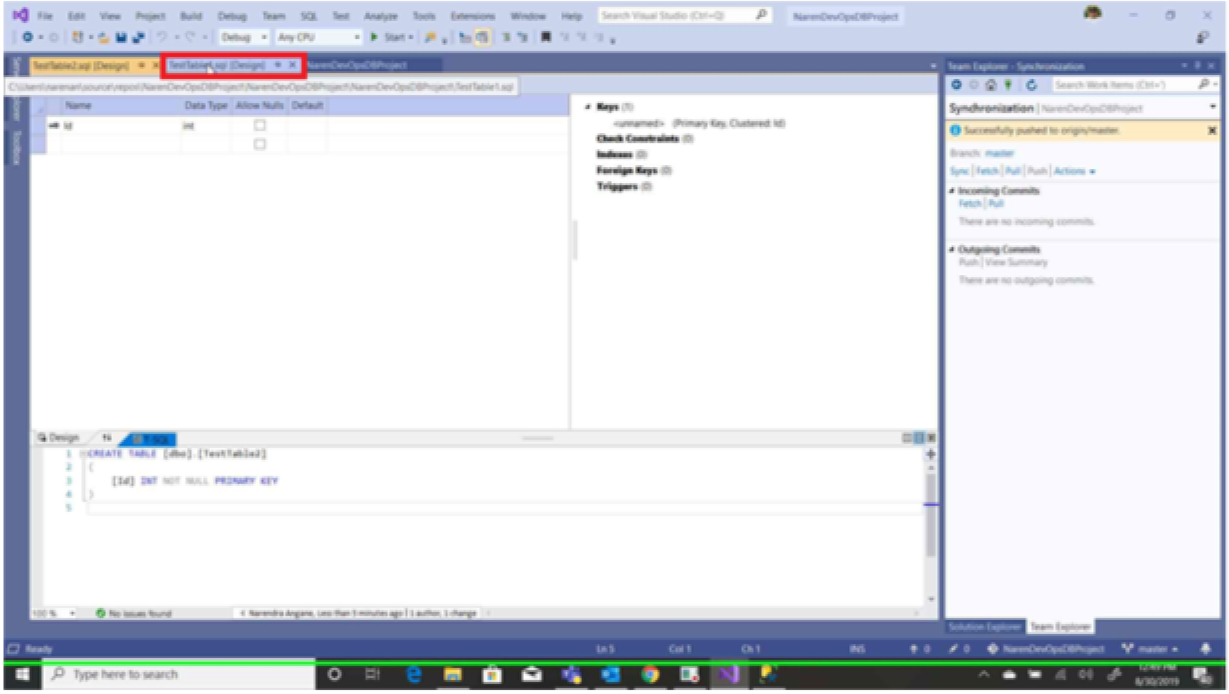
```
/****** Script for SelectTopNRows command from SSMS ******/
SELECT TOP (1000) *
  FROM [dbo].[TestTable1]
```

	Id
1	1
2	2
3	3
4	4
5	5

Query executed successfully. [redacted] NarenDevOpsDB 00:00:00 5 rows

Test Case 2

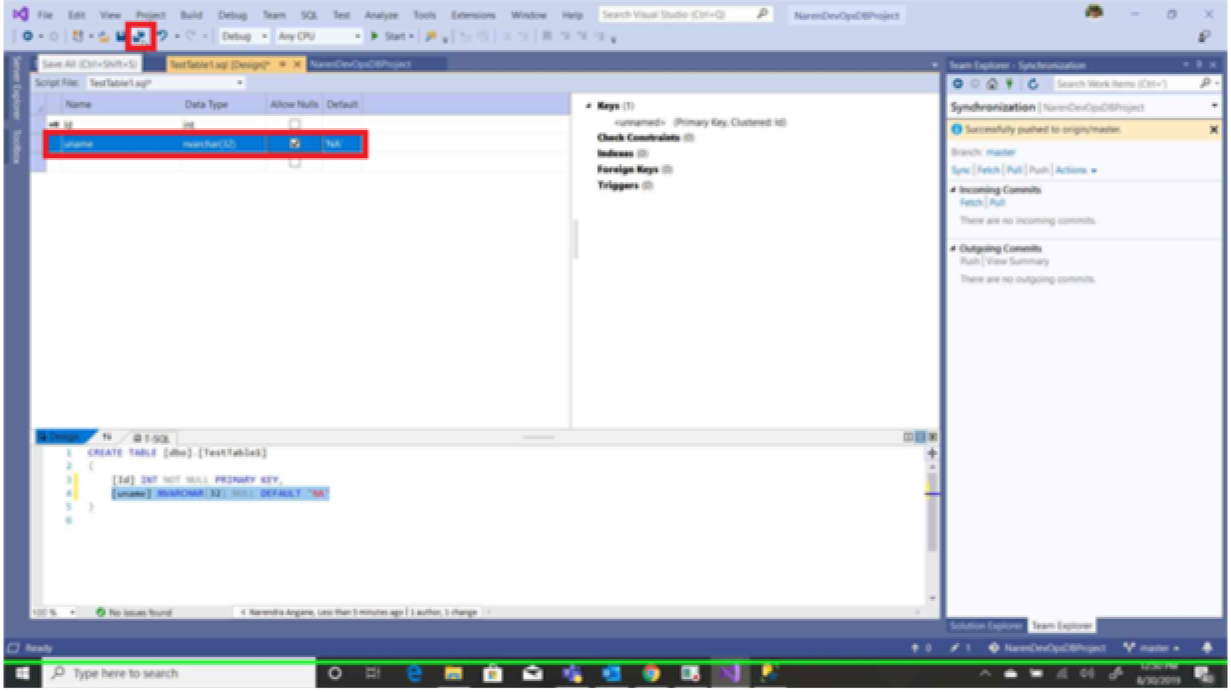
Step 1: Go back to the visual studio and open the testTable1 if it is close.



Name	Data Type	Allow Nulls	Default
Id	int	□	
		□	

```
CREATE TABLE [dbo].[TestTable2]
(
    [Id] INT NOT NULL PRIMARY KEY
)
```

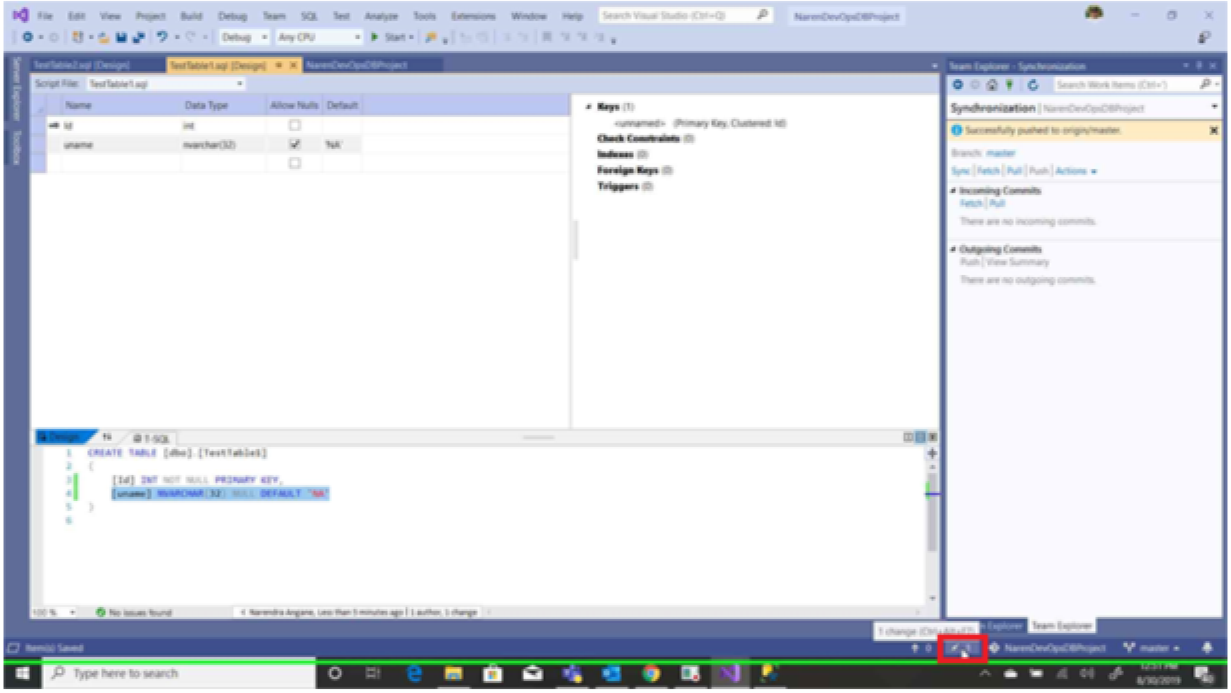
Step 2: Click on design tab and add uname column of nvarchar(32) type with allow nulls constraint. Click on "Save all" icon from the tool bar to save all the changes.



Name	Data Type	Allow Nulls	Default
Id	int	□	
uname	nvarchar(32)	☑	'NA'
		□	

```
CREATE TABLE [dbo].[TestTable1]
(
    [Id] INT NOT NULL PRIMARY KEY,
    [uname] NVARCHAR(32) NULL DEFAULT 'NA'
)
```

Step 3: Click on Team Explorer and Click bottom at the pencil icon to commit pending changes.



Team Explorer - Synchronization

Synchronization | NarenDevOpsDBProject

Successfully pushed to origin/master.

Branch: master

Sync | Fetch | Pull | Push | Actions

Incoming Commits

Fetch | Pull

There are no incoming commits.

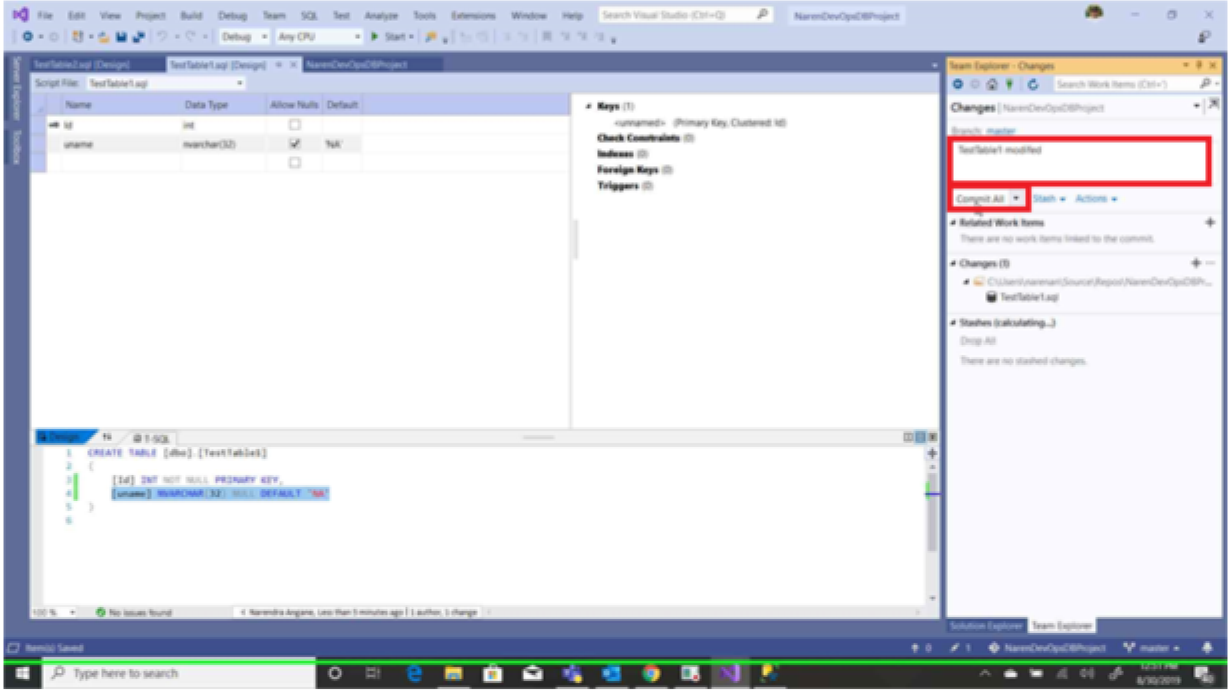
Outgoing Commits

Push | View Summary

There are no outgoing commits.

```
CREATE TABLE [dbo].[TestTable1]
(
    [Id] INT NOT NULL PRIMARY KEY,
    [uname] NVARCHAR(32) NULL DEFAULT 'NA'
)
```

Step 4: Click on Team Explorer and enter comments/description as “TestTable1 Modified” and click on “Commit All”.



Team Explorer - Changes

Changes | NarenDevOpsDBProject

Branch: master

TestTable1 modified

Commit All | Stash | Actions

Related Work Items

There are no work items linked to the commit.

Changes (1)

C:\Users\narenan\Source\Repos\NarenDevOpsDBP...

TestTable1.sql

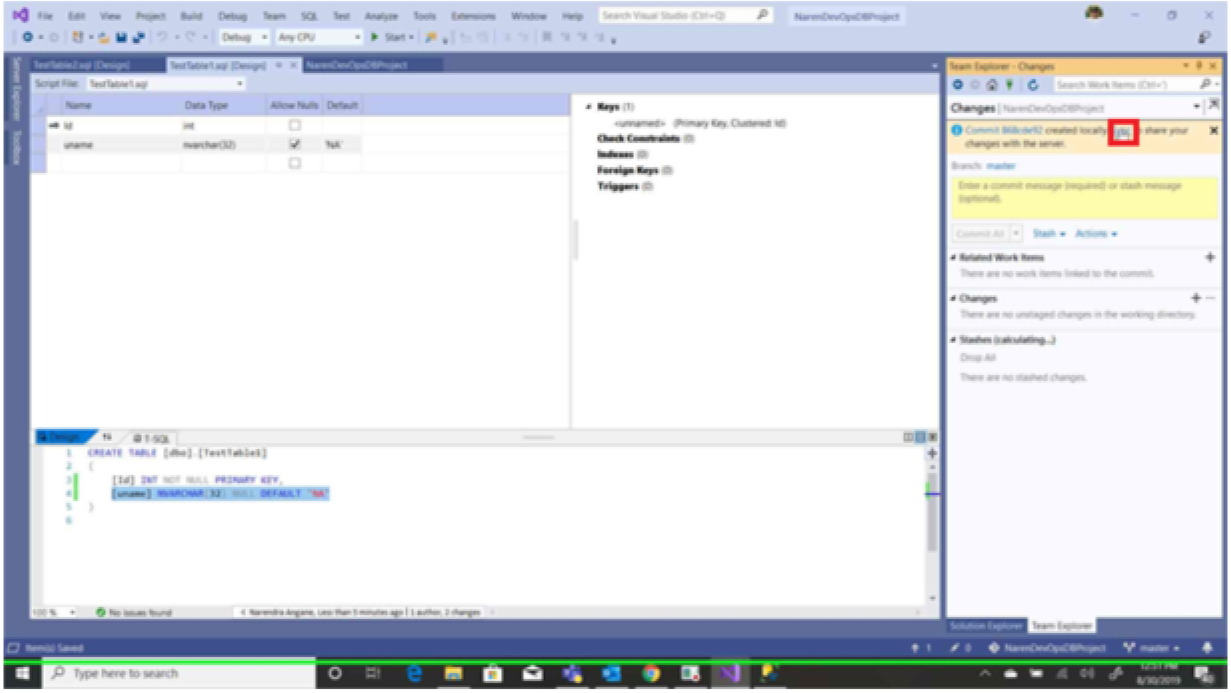
Stashes (calculating...)

Drop All

There are no stashed changes.

```
CREATE TABLE [dbo].[TestTable1]
(
    [Id] INT NOT NULL PRIMARY KEY,
    [uname] NVARCHAR(32) NULL DEFAULT 'NA'
)
```

Step 5: In Team Explorer window click on sync hyperlink to sync your locally committed changes on the server



Team Explorer - Changes

Changes | NarenDevOpsDBProject

Commit 868cde92 created locally. Sync to share your changes with the server.

Branch: master

Enter a commit message (required) or stash message (optional).

Related Work Items

There are no work items linked to the commit.

Changes

There are no unstaged changes in the working directory.

Stashes (calculating...)

Drop All

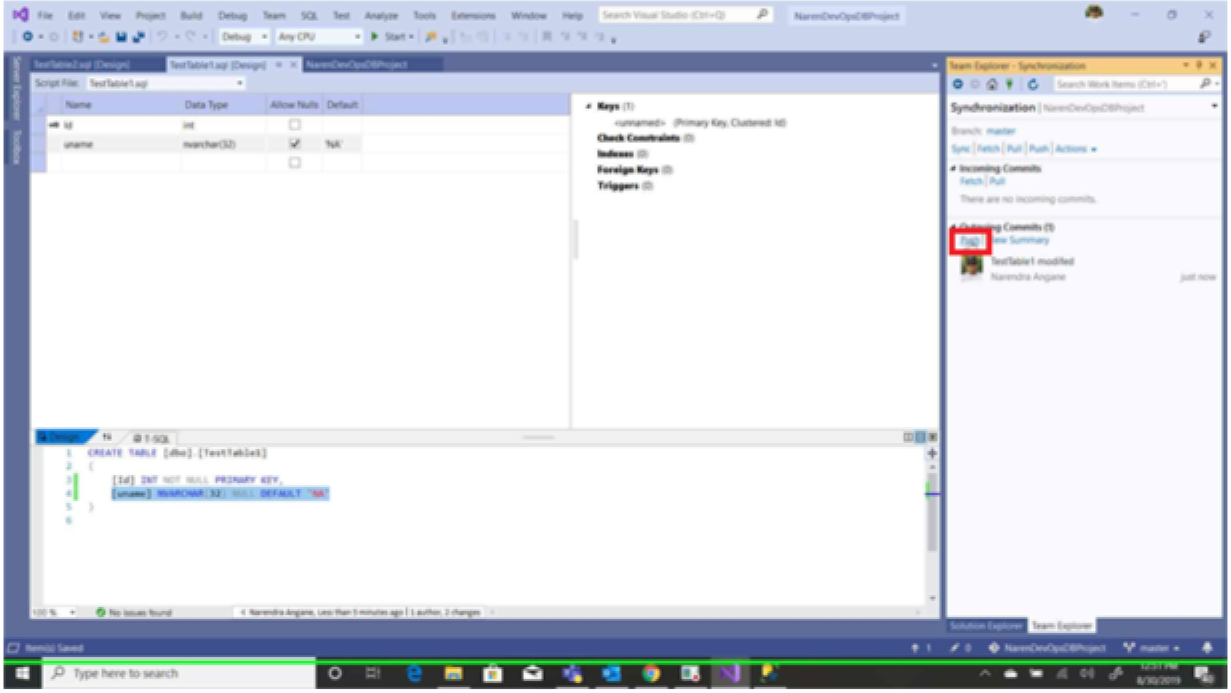
There are no stashed changes.

Name	Data Type	Allow Nulls	Default
Id	int	□	
uname	nvarchar(32)	☑	'NA'
		□	

Keys (1)
<unnamed> (Primary Key, Clustered: Id)
Check Constraints (0)
Indexes (0)
Foreign Keys (0)
Triggers (0)

```
CREATE TABLE [dbo].[TestTable1]
(
    [Id] INT NOT NULL PRIMARY KEY,
    [uname] NVARCHAR(32) NULL DEFAULT 'NA'
)
```

Step 6: In Team Explorer window click on Push hyperlink which you can found under Outgoing commit section to push the changes on the server



Team Explorer - Synchronization

Synchronization | NarenDevOpsDBProject

Branch: master

Sync | Fetch | Pull | Push | Actions

Incoming Commits

Fetch | Pull

There are no incoming commits.

Outgoing Commits (1)

Push | View Summary

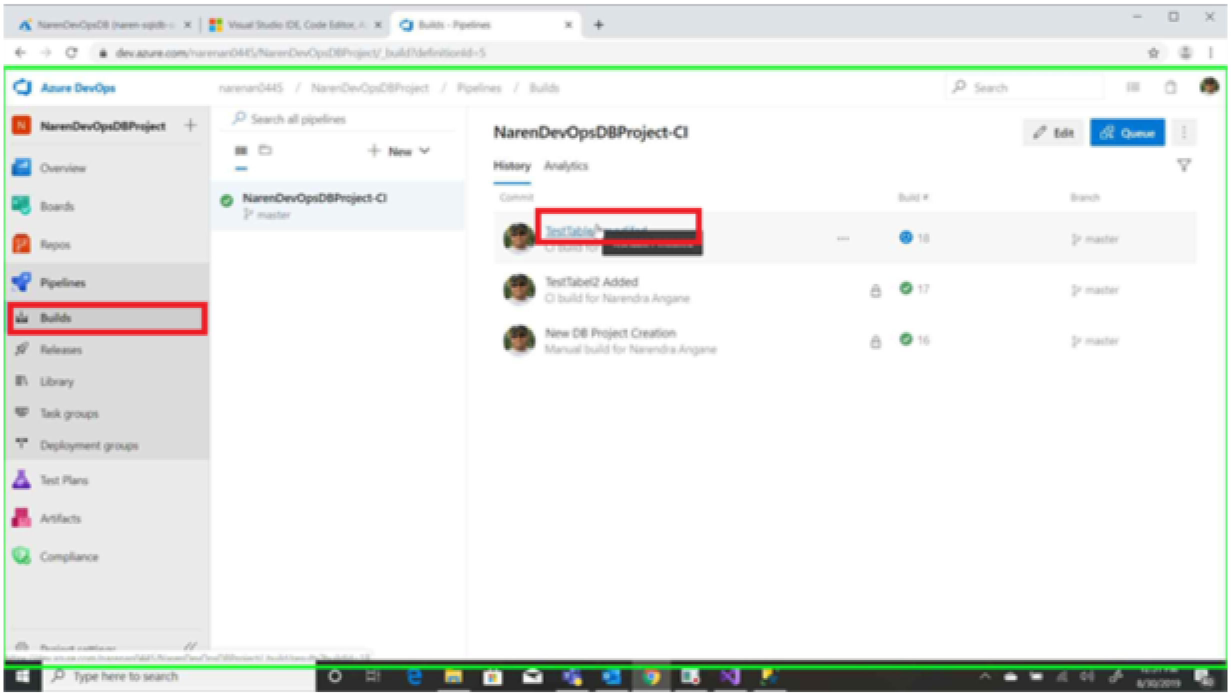
TestTable1 modified

Narendra Angane just now

Name	Data Type	Allow Nulls	Default
Id	int	□	
uname	nvarchar(32)	☑	'NA'
		□	

```
CREATE TABLE [dbo].[TestTable1]
(
    [Id] INT NOT NULL PRIMARY KEY,
    [uname] NVARCHAR(32) NULL DEFAULT 'NA'
)
```

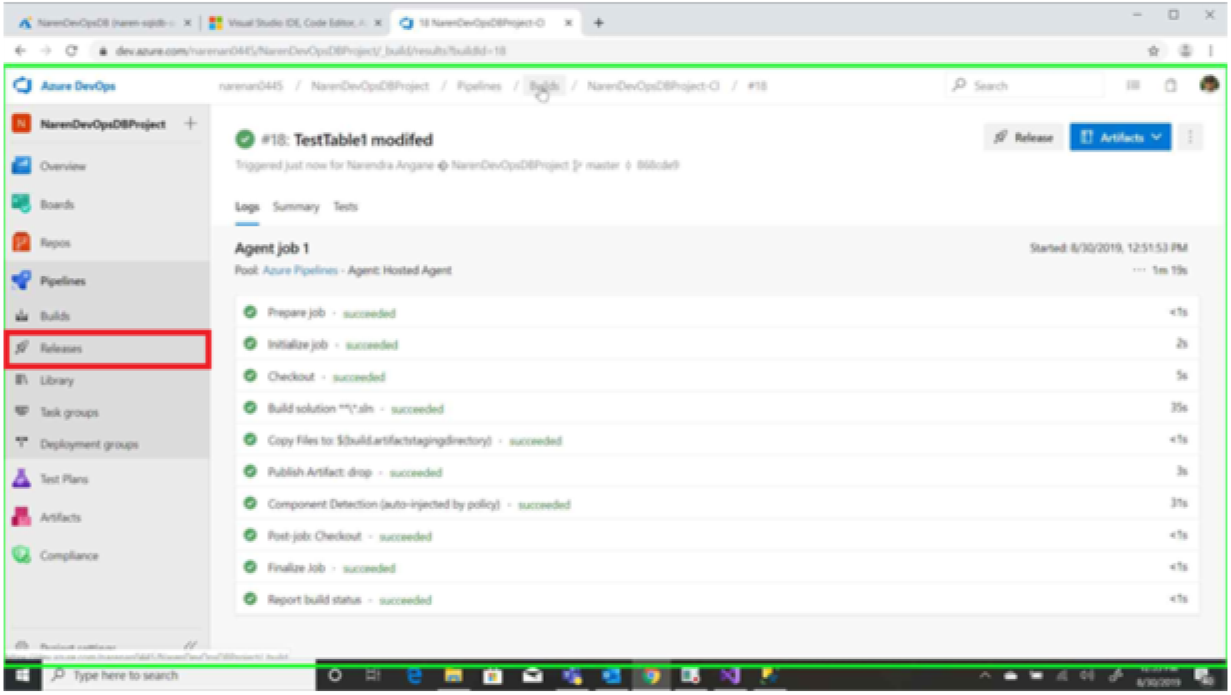
Step 7: Go to the DevOps page, click on Build from the left blade. You will see that “TestTable1 Modified” is also added in the build list. Click on “TestTable1 Modified” link. Click on “TestTable1 Modified” hyperlink to see the progress of the build pipeline. You will observe that the build pipeline is already stated without any manual activity. Do you remember the Trigger option we have set while building the Build Pipeline? (Refer the build pipeline section for more detail)



NarenDevOpsDBProject-CI

Commit	Build #	Branch
TestTable1 modifed CI build for	18	master
TestTabel2 Added CI build for Narendra Angane	17	master
New DB Project Creation Manual build for Narendra Angane	16	master

Step 8: You will see that build pipeline is successfully completed. Now you can see the progress of release pipeline by clicking on release from the left blade



#18: TestTable1 modifed

Triggered just now for Narendra Angane NarenDevOpsDBProject master 868cde9

Agent job 1

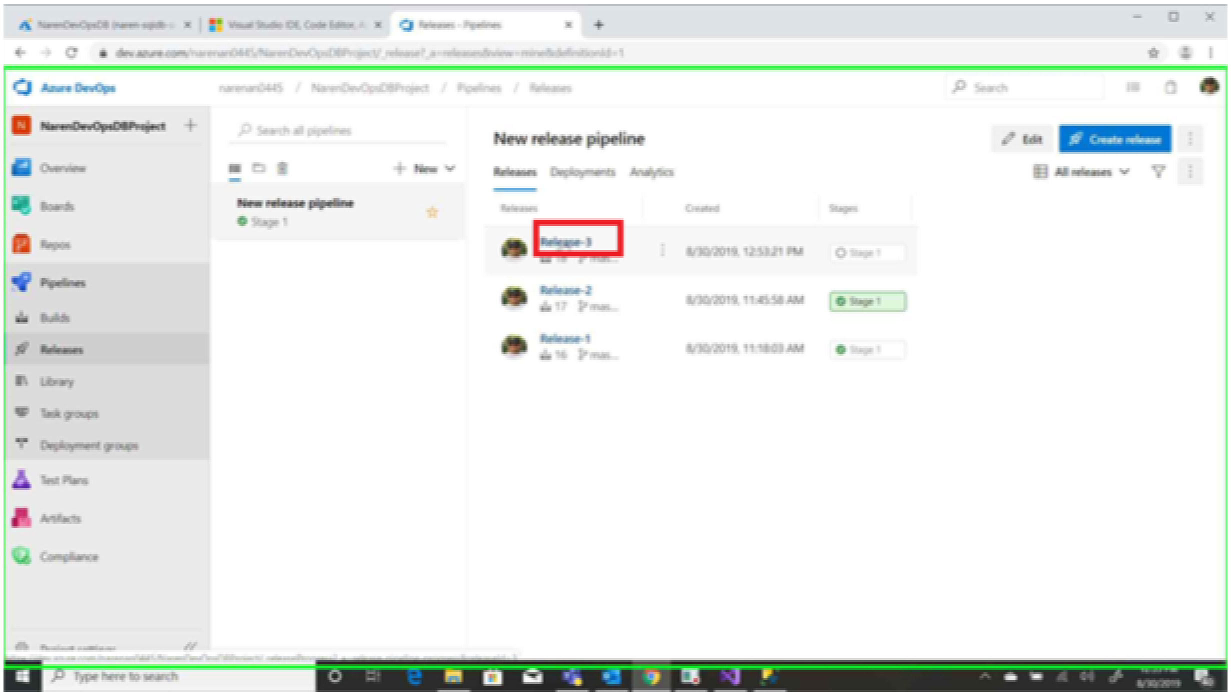
Pool: Azure Pipelines · Agent: Hosted Agent

Started: 8/30/2019, 12:51:53 PM

1m 19s

```
Prepare job · succeeded                                              <1s
Initialize job · succeeded                                            2s
Checkout · succeeded                                                  5s
Build solution **\*.sln · succeeded                                  35s
Copy Files to: $(build.artifactstagingdirectory) · succeeded         <1s
Publish Artifact: drop · succeeded                                    3s
Component Detection (auto-injected by policy) · succeeded            31s
Post-job: Checkout · succeeded                                       <1s
Finalize Job · succeeded                                             <1s
Report build status · succeeded                                      <1s
```

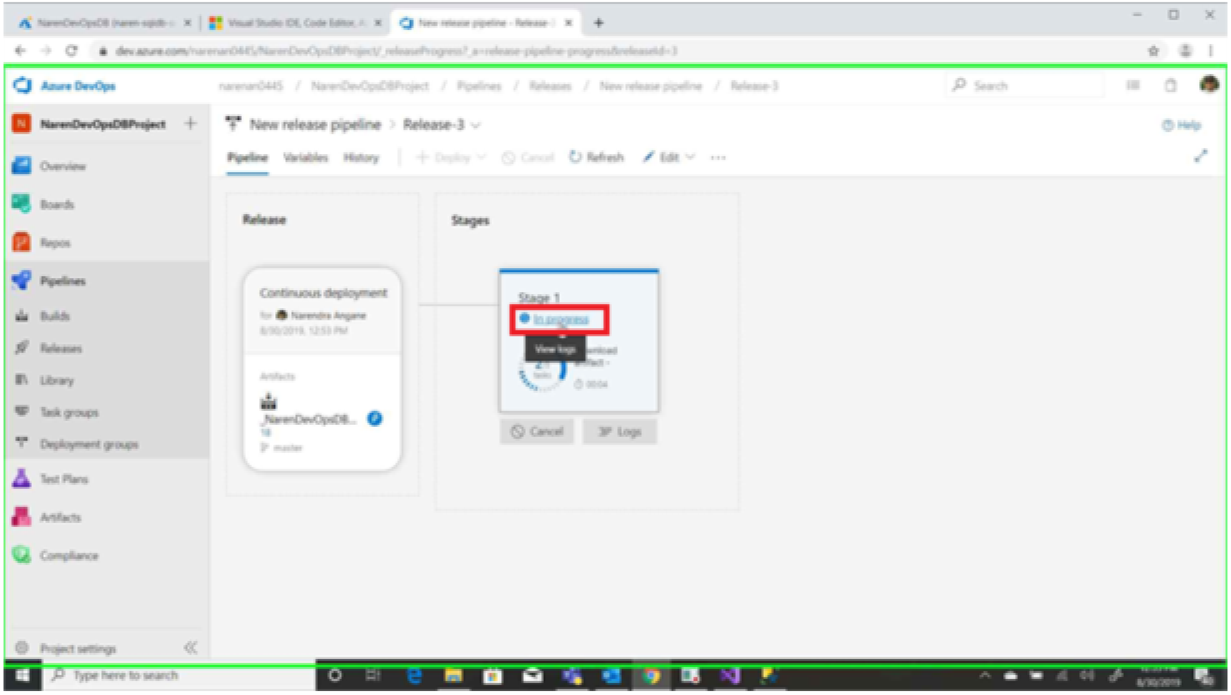
Step 9: It will open the release pipeline blade where you can see the "Release 3" is running. To see the detail of "Release 3" you can click on "Release 3" hyperlink



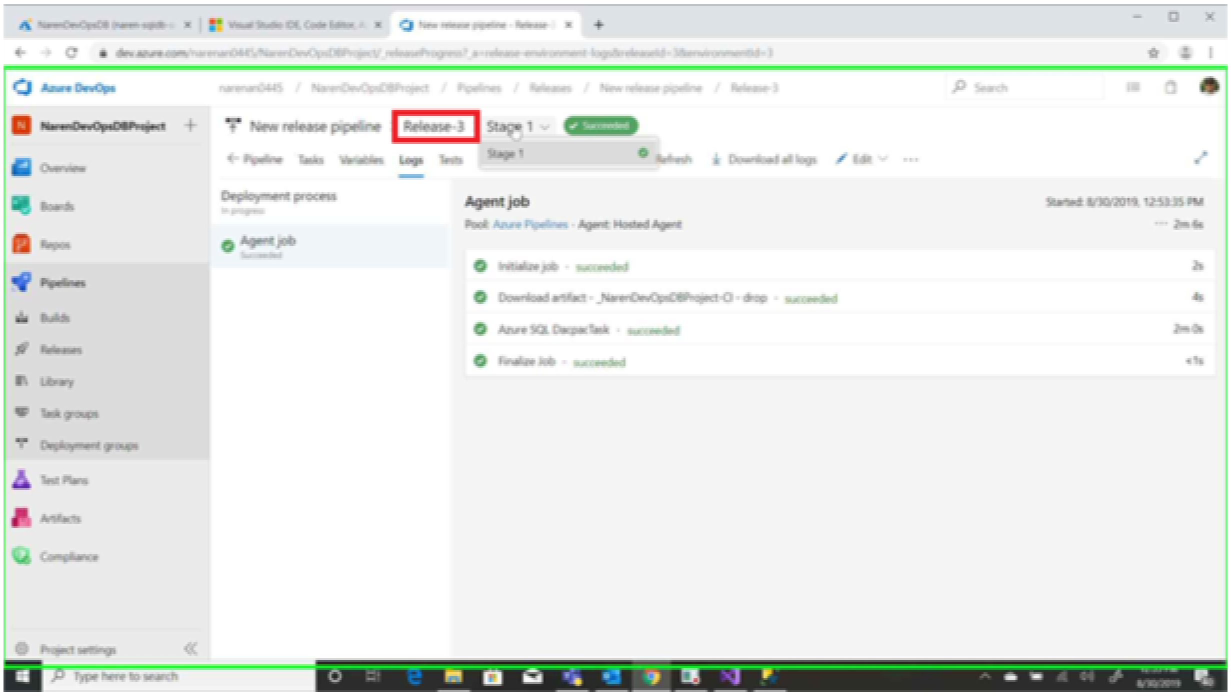
New release pipeline

Releases	Created	Stages
Release-3	8/30/2019, 12:53:21 PM	Stage 1
Release-2	8/30/2019, 11:45:58 AM	Stage 1
Release-1	8/30/2019, 11:18:03 AM	Stage 1

Step 10: On the “Release 3” blade click on “In progress” hyperlink which you can find it in stage1 windows



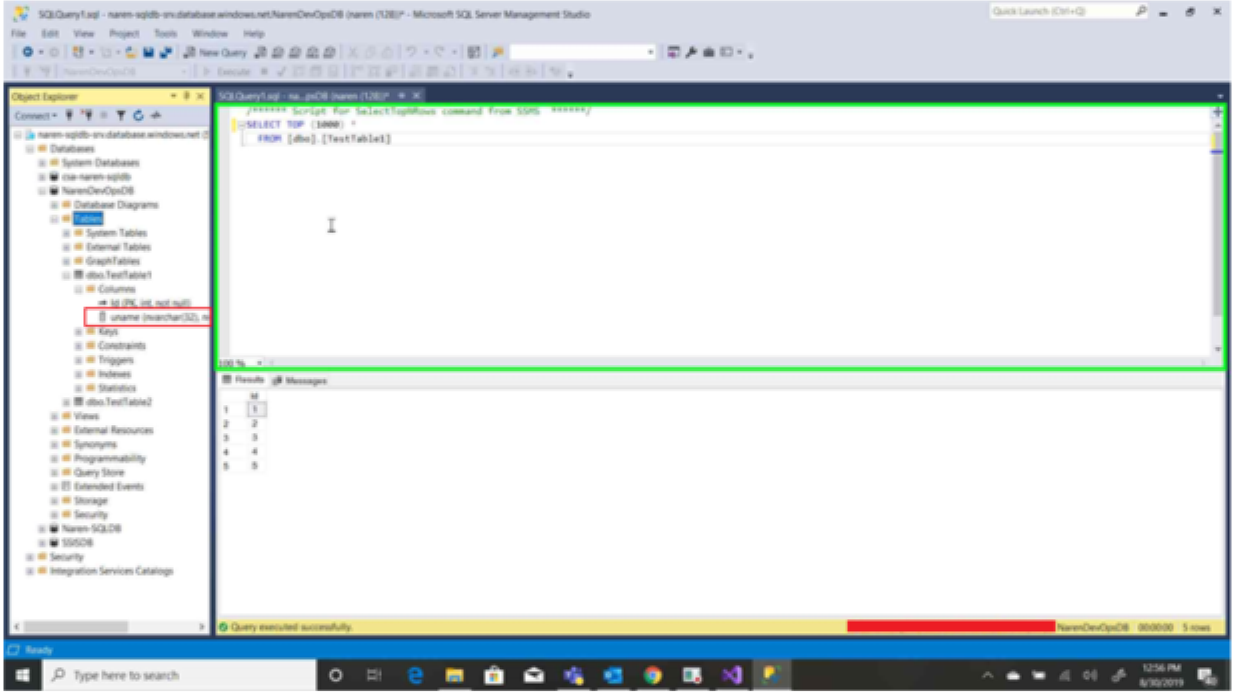
Step 11: After completion of “Release 3” pipeline you can see the similar window as follow. If you want to go back to Release-3 pipeline click on Release-3 hyperlink.



Agent job
Pool: Azure Pipelines · Agent: Hosted Agent
Started: 8/30/2019, 12:53:35 PM
2m 6s

```
Initialize job · succeeded                                  2s
Download artifact - _NarenDevOpsDBProject-CI - drop · succeeded   4s
Azure SQL DacpacTask · succeeded                            2m 0s
Finalize Job · succeeded                                    <1s
```

Step 12: Go to the SSMS. In object explorer Expand SQL Server -> Databases -> [Deployed Database Name] ->Tables -> dbo.TestTable1 -> Columns. You will notice that newly added column named uname appear in object explorer.



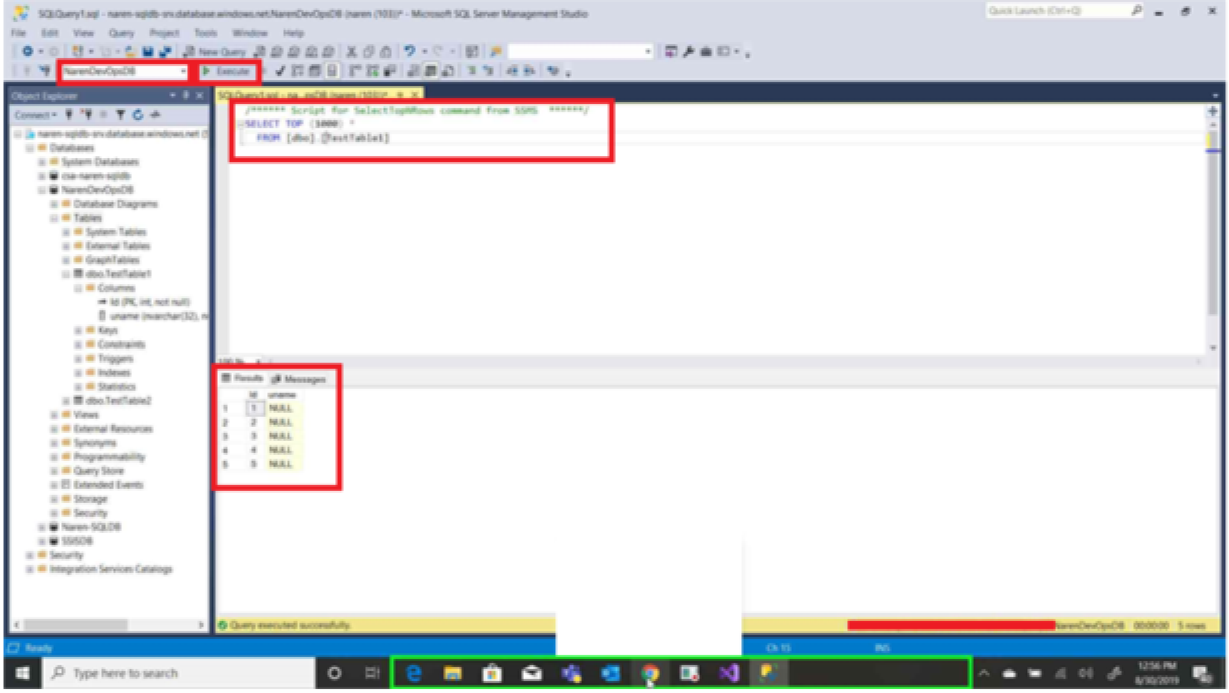
```
/****** Script for SelectTopNRows command from SSMS  ******/
SELECT TOP (1000) *
  FROM [dbo].[TestTable1]
```

	Id
1	1
2	2
3	3
4	4
5	5

Query executed successfully.

Step 13: Run the following query on targeted database
SELECT TOP (1000) * FROM [dbo].[TestTable1];
GO
You will notice that, we still see the 5 records what we have added before along with the new column named uname (with null values). It also confirms that, every time when CICD pipeline

executed it compare the BACPAC with Azure SQL Database schema and execute only delta instead of executing whole BACPAC.



```
/****** Script for SelectTopNRows command from SSMS  ******/
SELECT TOP (1000) *
  FROM [dbo].[TestTable1]
```

	Id	uname
1	1	NULL
2	2	NULL
3	3	NULL
4	4	NULL
5	5	NULL

Query executed successfully.

NarenDevOpsDB 00:00:00 5 rows

Congratulation! You have completed both the test cases