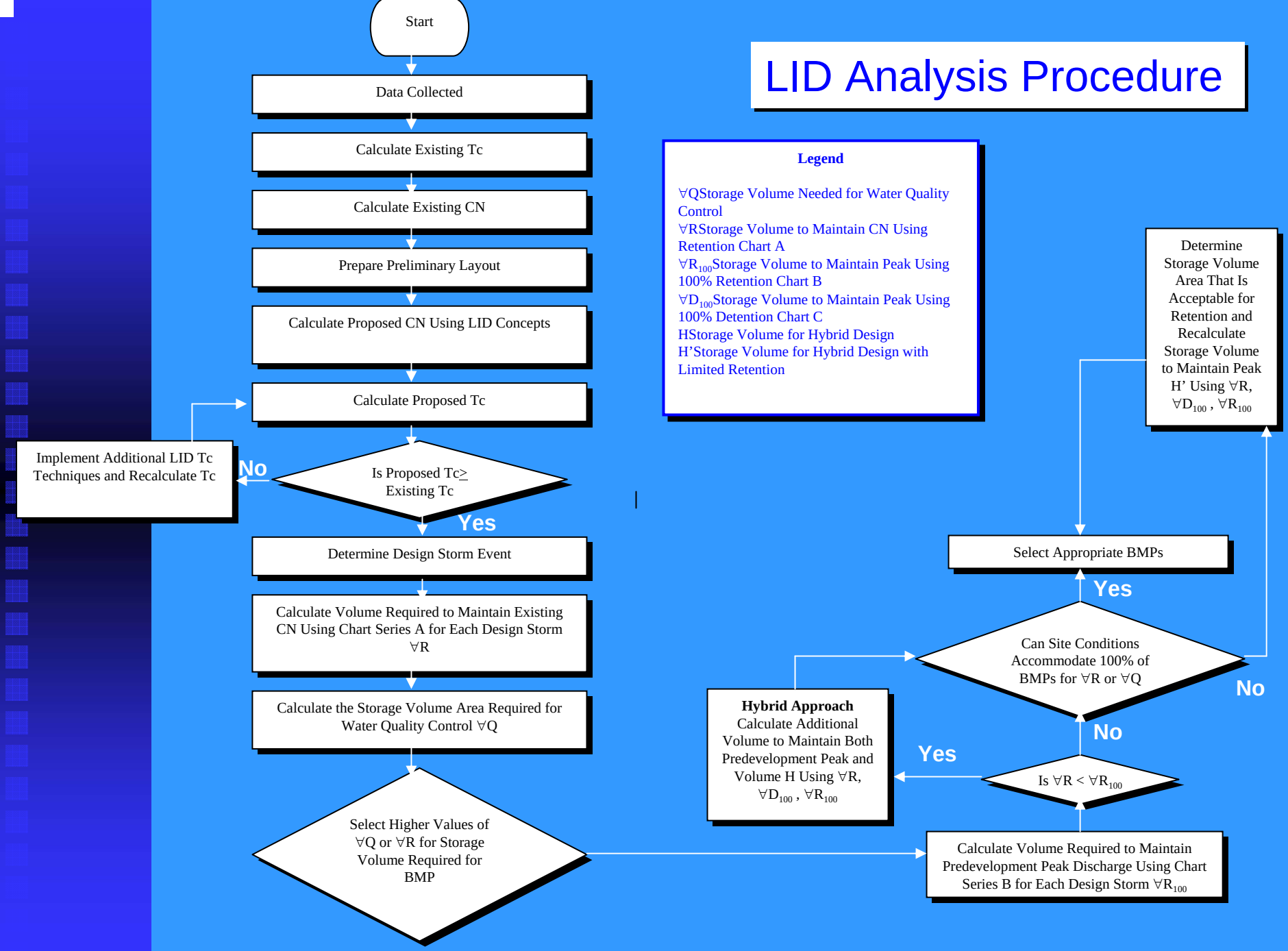
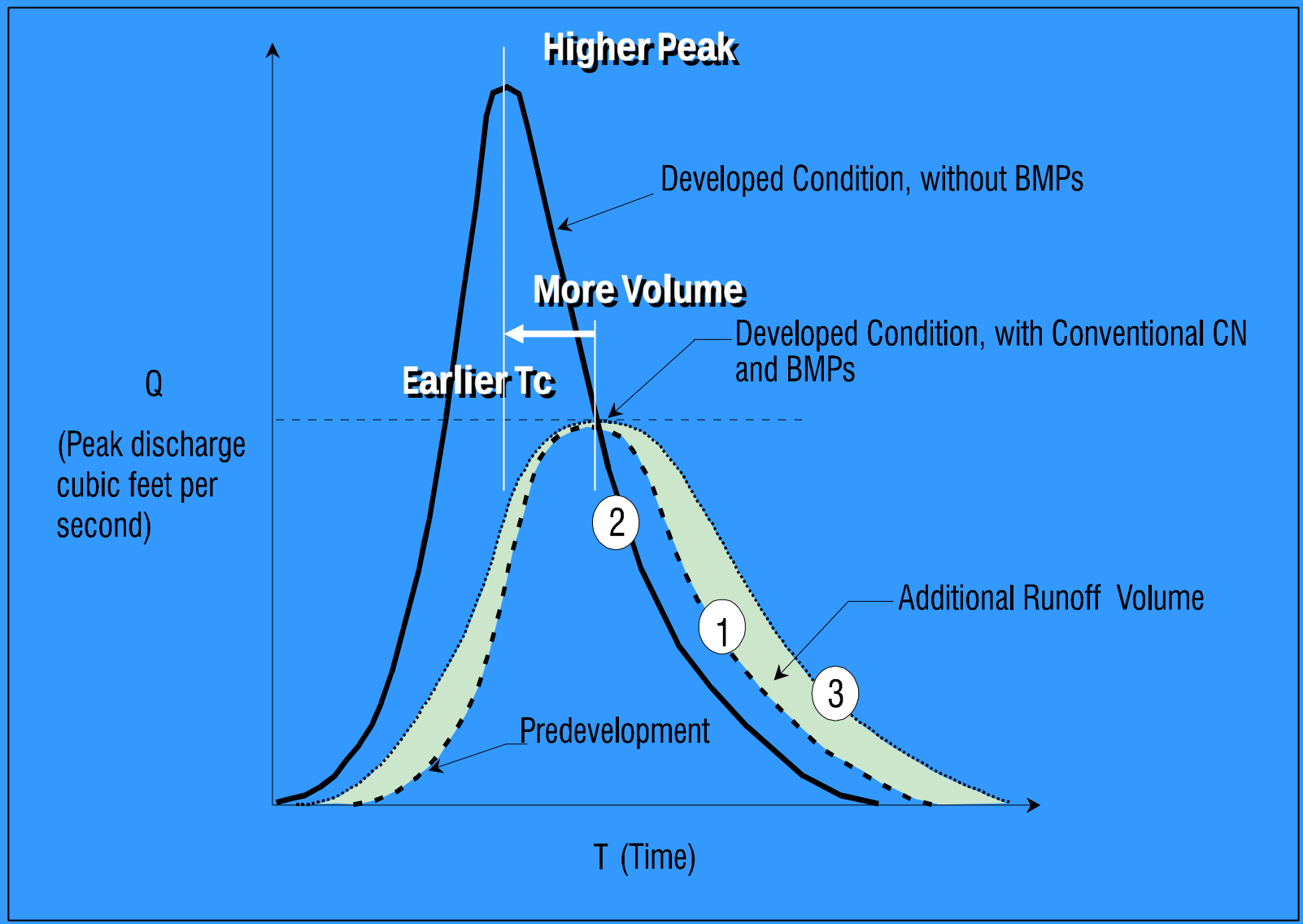
Low Impact Development Hydrologic Analysis

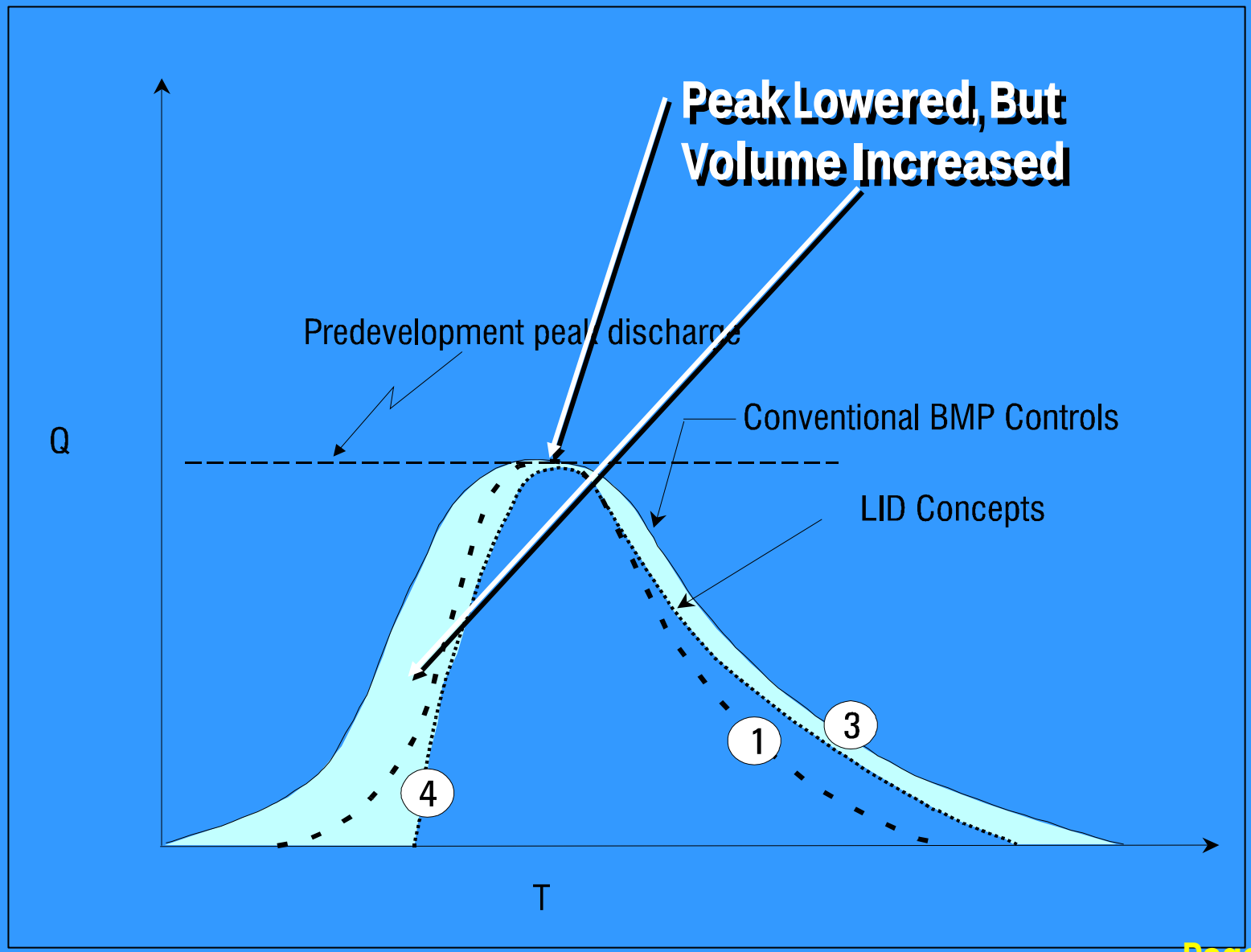
LID Analysis Procedure



Hydrologic Response of Conventional BMPs



Comparison of Conventional vs. LID BMPs



LID "Functional Landscape"

- Runoff Volume Control
- Peak Runoff Rate Control
- Flow Frequency/Duration Control
- Water Quality Control


Man-Made
Wetlands
Roadside Swale

LID Design Approach:

- **CN:** Minimize change, reduce impervious areas, preserve trees and pervious soils.
- **Tc:** Lengthen flowpath and reduce piped systems.
- **Retention:** Maintain pre-development storage volume.
- **Detention:** Provide additional storage to maintain peak runoff rates

Hydrologic Evaluation:

- LID Runoff Curve Number (CN)
- Time of Concentration (Tc)
- Runoff Volume
- Additional Detention

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Hydrologic Evaluation:

- LID Runoff Curve Number (CN)
- Time of Concentration (Tc)
- Runoff Volume
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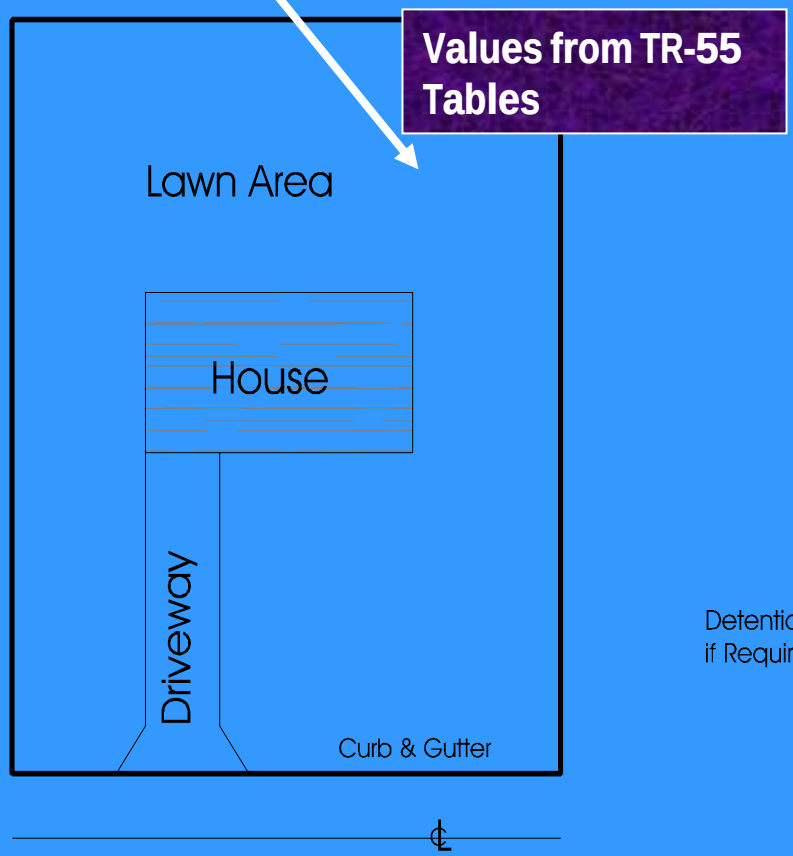
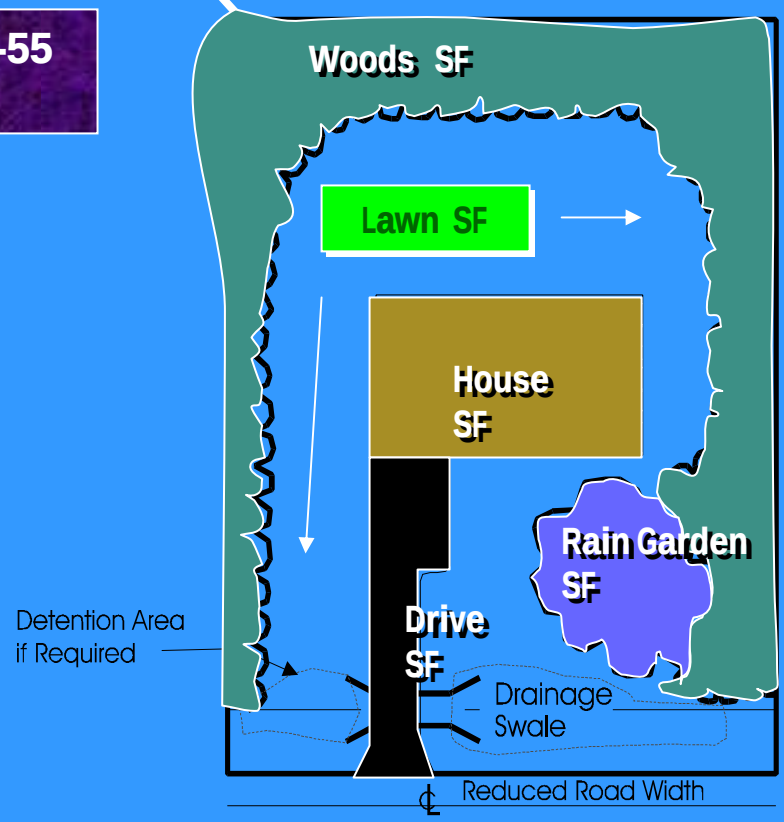
Conventional Vs. LID Curve Numbers (CN)

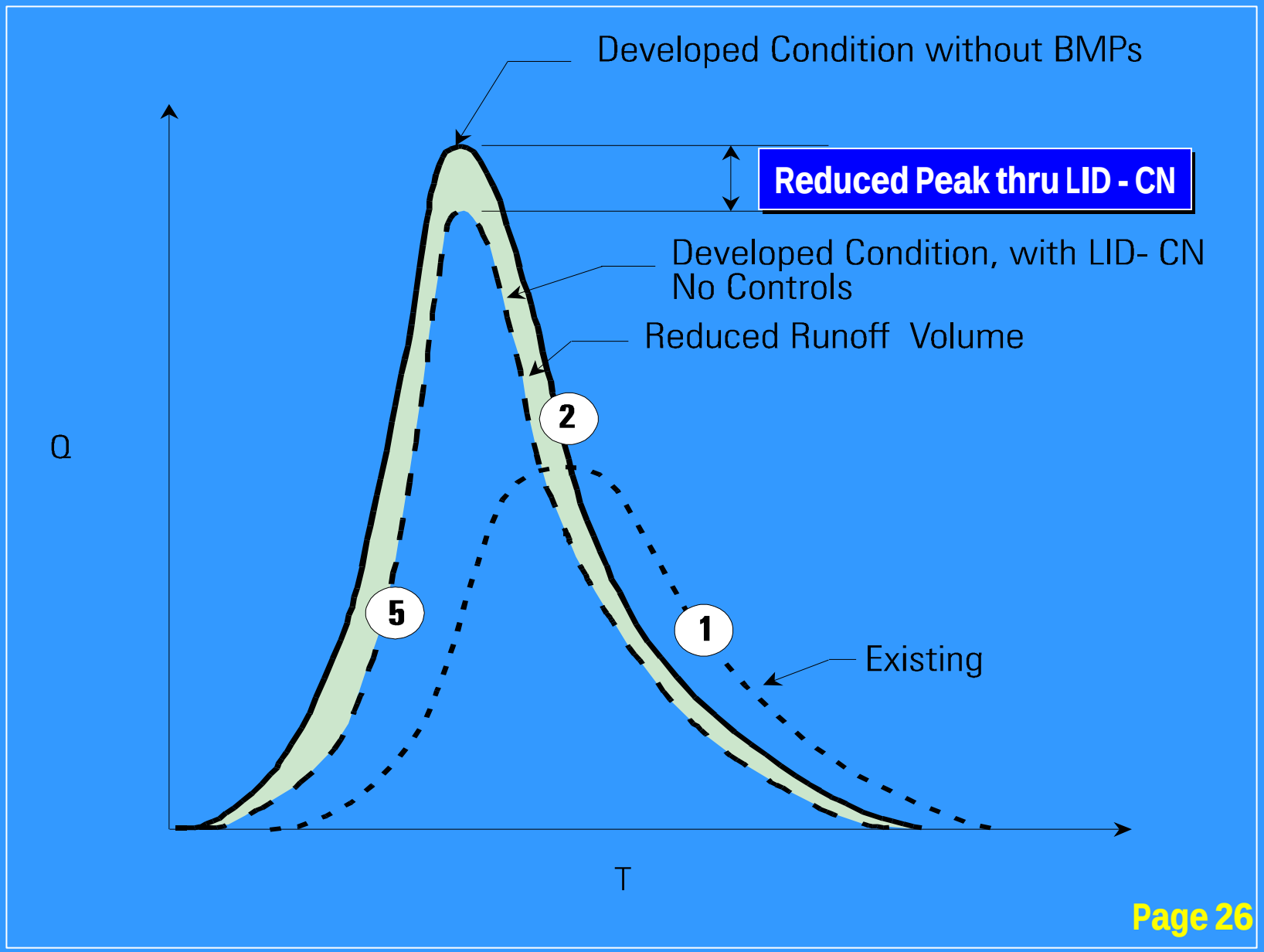


Conventional CN
for 1-Acre Lot
(Table 2.2a TR-55)
N.T.S.



Typical Low-Impact
Development Lot
N.T.S.

Maintaining CN without Storm Water BMPs



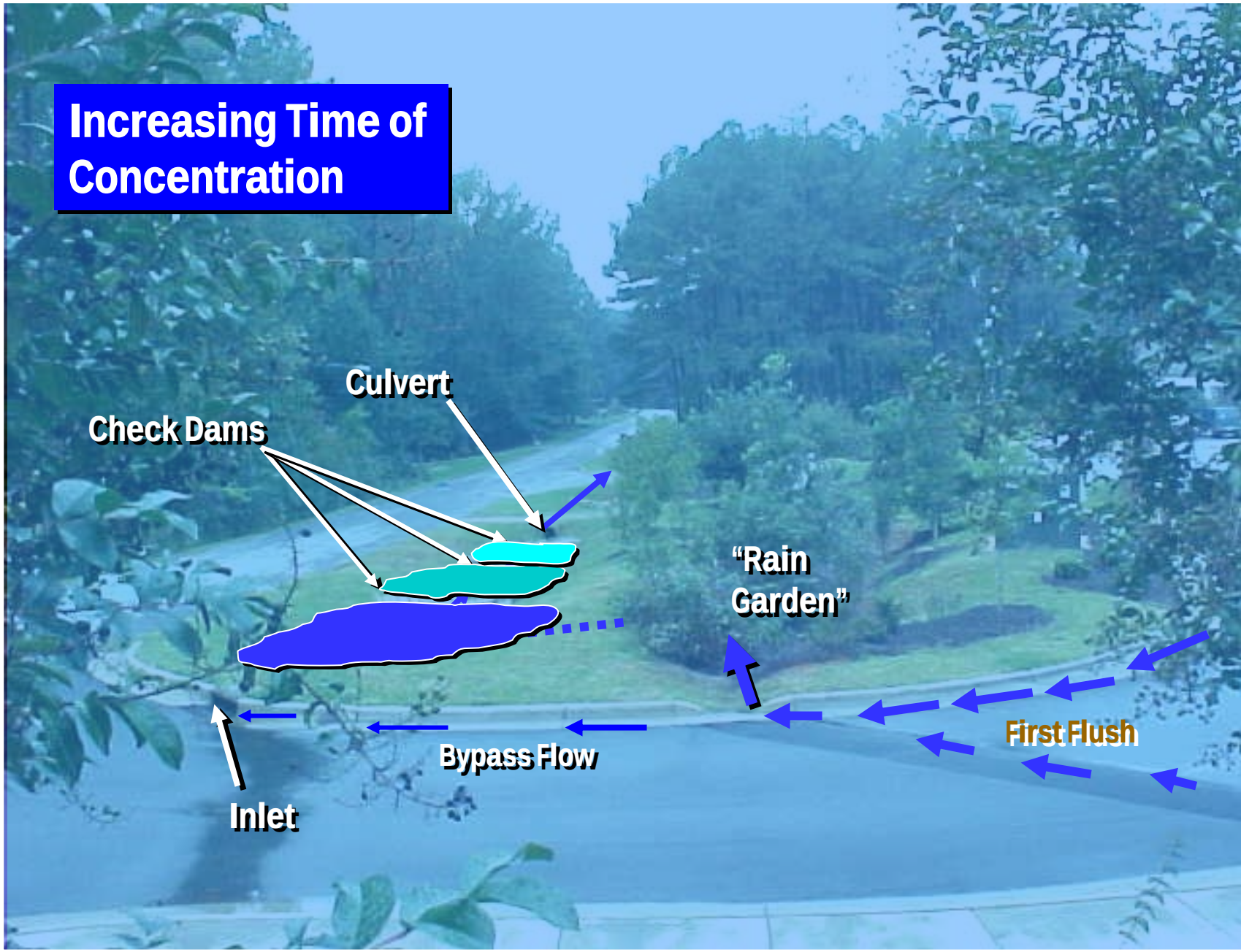
Hydrologic Evaluation:

- LID Runoff Curve Number (CN)
- Time of Concentration (Tc)
- Runoff Volume
- Additional Detention

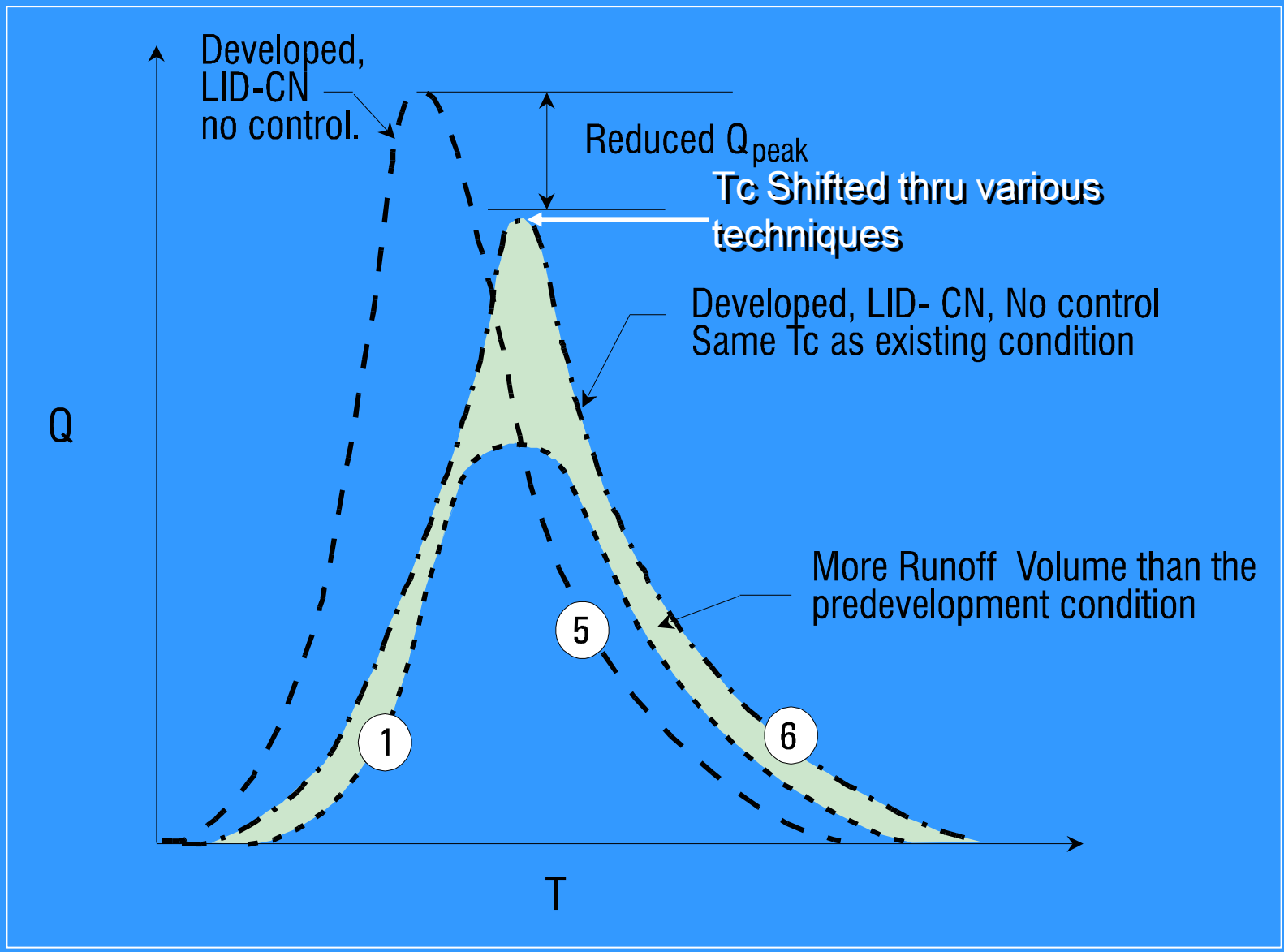
Techniques to Maintain Tc

- Use natural drainage patterns and swales to maintain or lengthen flow path length.
- Increase surface roughness. (Swales instead of Gutter)
- Detain flows (Rain Gardens, check dams, open swales)
- Minimize Disturbance.
- Flatten grades in impacted areas.
- Disconnect impervious areas
- Connect pervious and vegetated areas.

Increasing Time of Concentration



Maintaining CN and Tc Without Storm Water BMPs



Hydrologic Evaluation:

- LID Runoff Curve Number (CN)
- Time of Concentration (Tc)
- **Runoff Volume**
- Additional Detention

Techniques to Decrease Runoff Volume

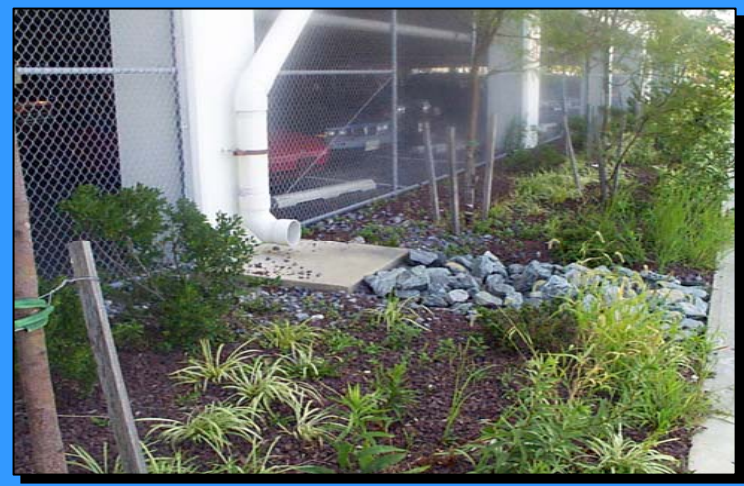
- Infiltration Trenches
- Rain Gardens (Bio-Retention Areas)
- Retention Ponds
- Irrigation Ponds (Golf Course, Common Area)
- Rain Barrels and Cisterns
- Rooftop Storage

Rain Garden

Rain Barrel

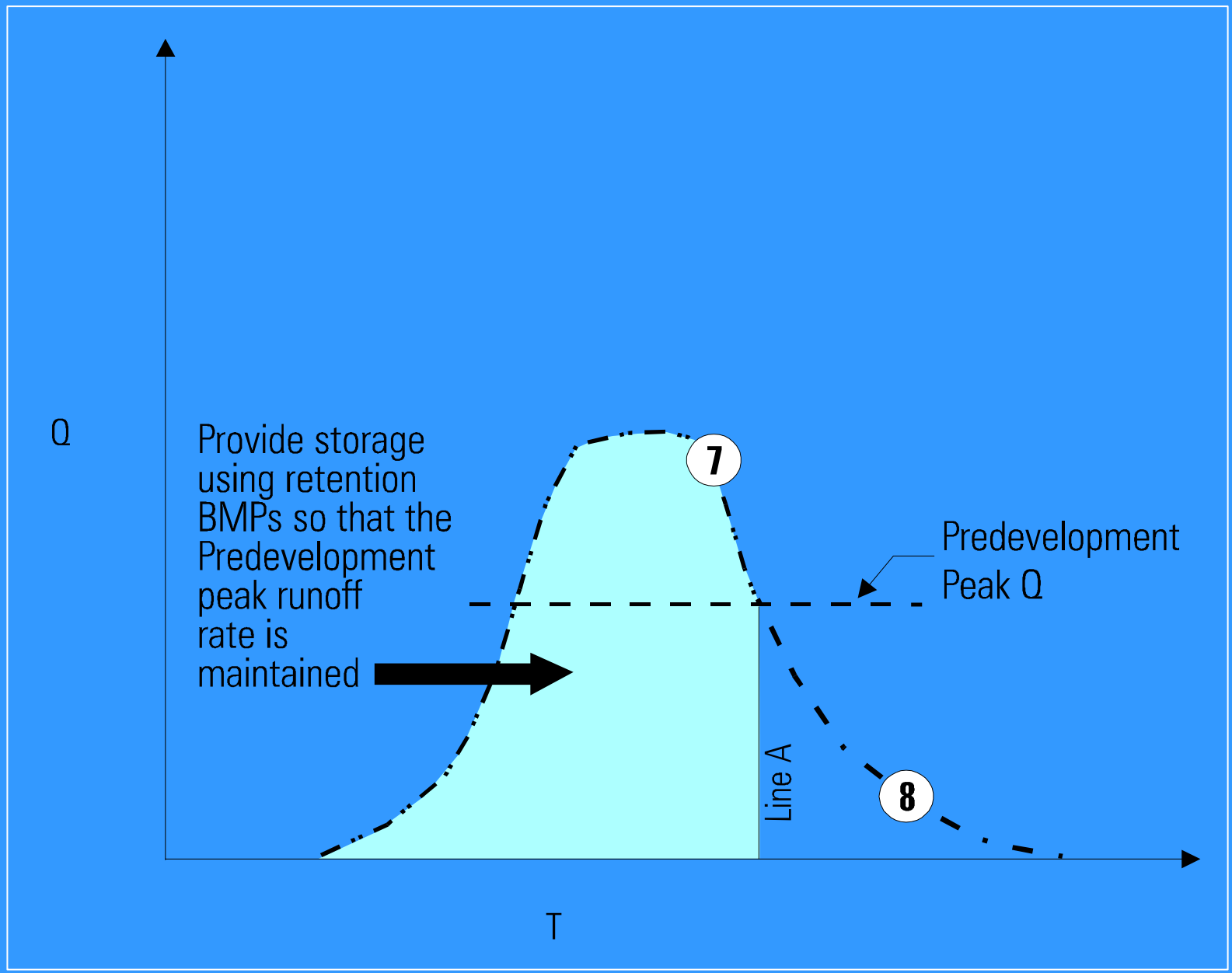
Aesthetic Dry Detention Pond

Dry Detention Basin



Infiltration Trench

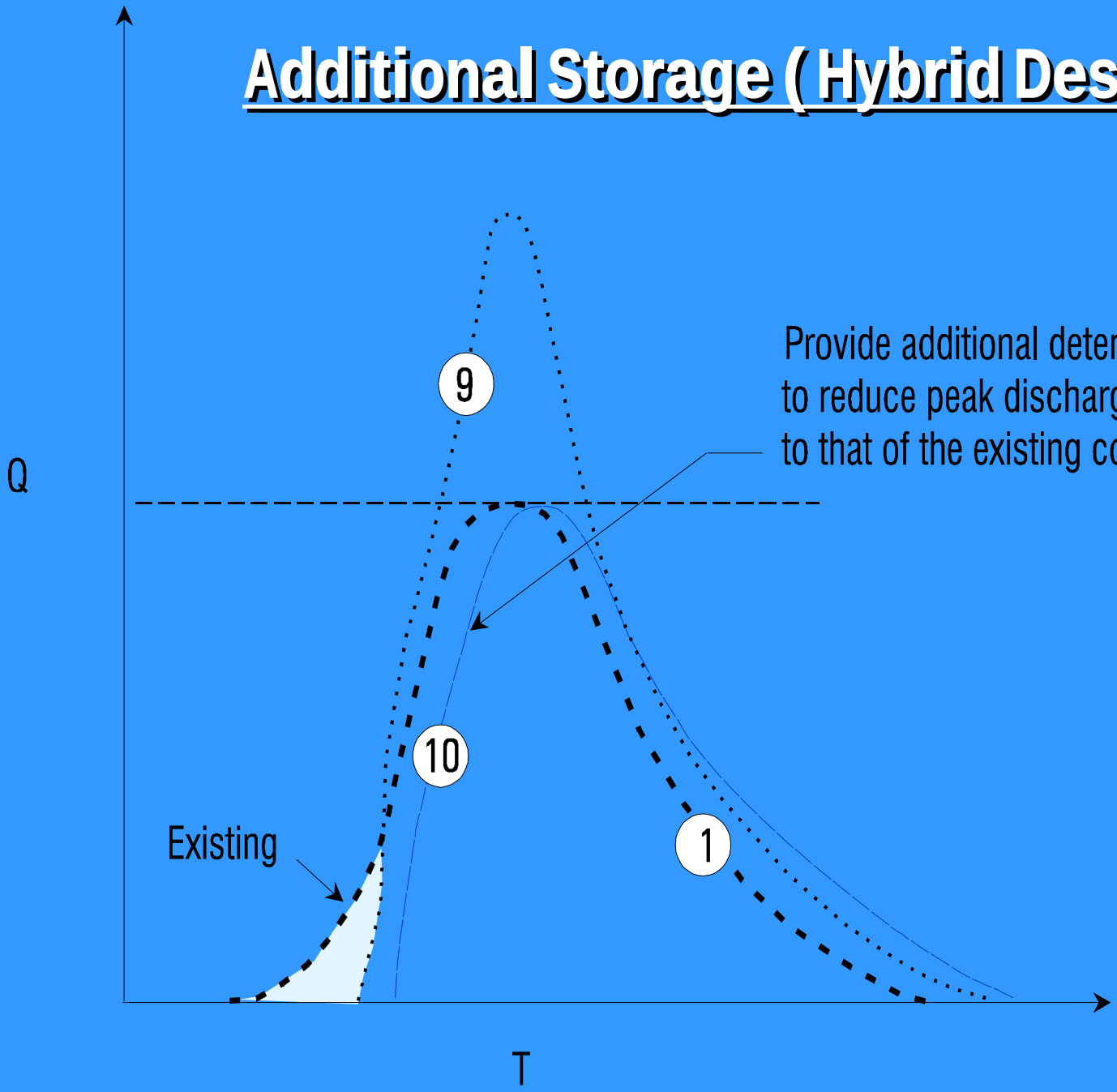
Retention Storage (BMPs) to Maintain Runoff Rate



Hydrologic Evaluation:

- LID Runoff Curve Number (CN)
- Time of Concentration (Tc)
- Runoff Volume
- Additional Detention

Additional Storage (Hybrid Design)



Provide additional detention storage to reduce peak discharges to be equal to that of the existing condition.

Determine storage volume required to maintain runoff volume or CN. Use Chart Series A: Storage Volume Required to Maintain the Pre-development Runoff Volume Using Retention Storage (Example 5.2).

Step 1

Determine storage volume for Water Quality volume requirements. Determine the storage volume required for quality control BMPs. Use larger of volumes to maintain CN (Step 1, Example 5.2) or water quality volume. (Example 5.3).

Step 2

Determine storage volume required to maintain predevelopment peak runoff rate using 100% retention. Use Chart Series B: Storage Volume Required to Maintain the Predevelopment Peak Runoff Rate Using 100% Retention.

Step 3

Determine whether additional detention storage is required to maintain pre-development peak runoff rate. Compare the results of Steps 1 and 2 to the results of Step 3. If the storage volume in Steps 1 and 2 is determined to be greater than that in Step 3, the storage volume required to maintain the predevelopment CN also controls the peak runoff rate. No additional detention storage is needed. If the site area in Step 1 is less than that in Step 3, additional detention storage is required to maintain the peak runoff rate (Example 5.4).

Step 4

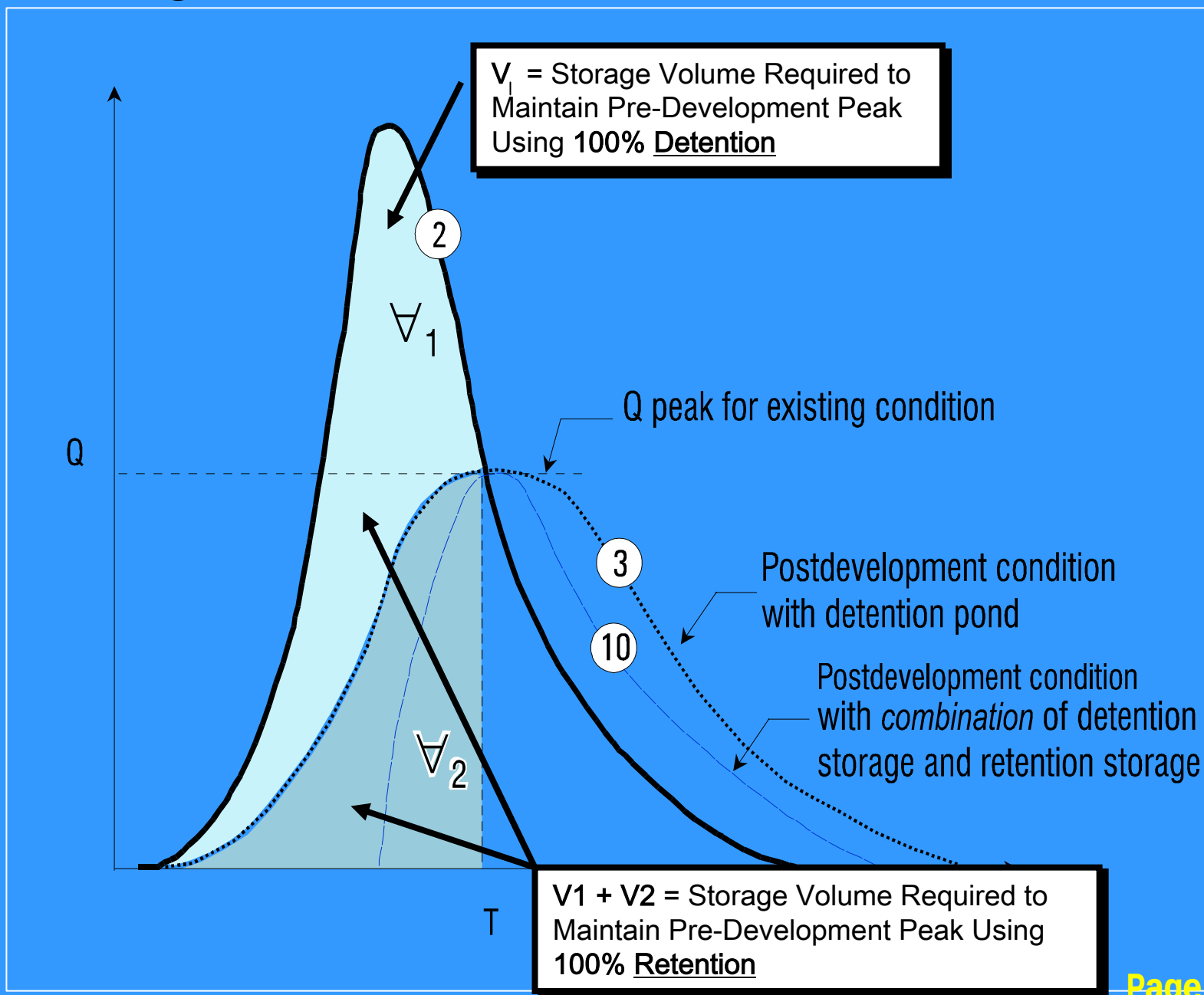
If

Determine storage volume required to maintain predevelopment peak runoff rate using 100% detention. Use Chart Series C: Storage Volume Required to Maintain the Predevelopment Peak Runoff Rate Using 100% Detention. This is used in conjunction with Chart Series A and B to determine the hybrid volume in Step 6.

"Hybrid approach". Use results from Chart Series A, B, and C to determinestorage volume s to maintain both the predevelopment peak runoff rate and runoff volume. Refer to Equations 5.5 and 5.6 as found in Example 5.4.

Determine appropriate percent of site available for retention practices. If the storage volume available for retention practices is less than the storage determined in Step 3, recalculate the amount of BMP area required to maintain the peak runoff rate while attenuating some volume using the procedure in Example 5.6 using Equations 5.7 and 5.8.

Storage Volume to Maintain Peak Runoff Rate



Determine storage volume required to maintain runoff volume or CN. Use Chart Series A: Storage Volume Required to Maintain the Pre-development Runoff Volume Using Retention Storage (Example 5.2).

Determine percentage of site for Water Quality volume requirements. Determine the storage volume required for quality control BMPs. Use larger of volumes to maintain CN (Step 1, Example 5.2) or water quality volume. (Example 5.3).

Determine storage volume required to maintain predevelopment peak runoff rate using 100% retention. Use Chart Series B: Storage Volume Required to Maintain the Predevelopment Peak Runoff Rate Using 100% Retention.

Determine whether additional detention storage is required to maintain pre-development peak runoff rate. Compare the results of Steps 1 and 2 to the results of Step 3. If the storage volume in Steps 1 and 2 is determined to be greater than that in Step 3, the storage volume required to maintain the predevelopment CN also controls the peak runoff rate. No additional detention storage is needed. If the site area in Step 1 is less than that in Step 3, additional detention storage is required to maintain the peak runoff rate (Example 5.4).

If

Step 5

Determine storage volume required to maintain predevelopment peak runoff rate using 100% detention. Use Chart Series C: Storage Volume Required to Maintain the Predevelopment Peak Runoff Rate Using 100% Detention. This is used in conjunction with Chart Series A and B to determine the hybrid volume in Step 6.

Step 6

Hybrid approach. Use results from Chart Series A, B, and C to determine storage volume s to maintain both the predevelopment peak runoff rate and runoff volume. Refer to Equations 5.5 and 5.6 as found in Example 5.4.

Step 7

Determine appropriate storage volume available for retention practices. If the storage volume available for retention practices is less than the storage determined in Step 3, recalculate the amount of BMP area required to maintain the peak runoff rate while attenuating some volume using the procedure in Example 5.6 using Equations 5.7 and 5.8.

Any Questions ?