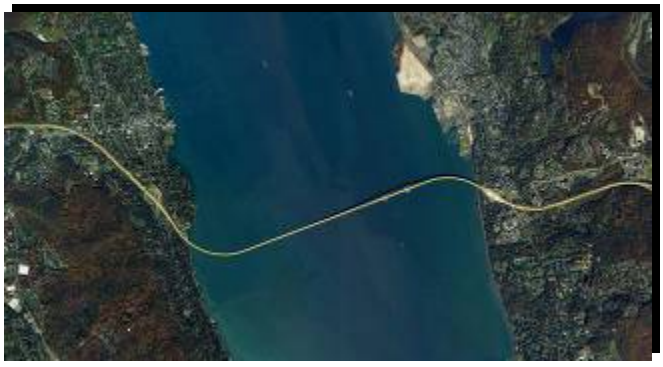
New York State Department of Transportation
Metropolitan Transportation Authority Metro-North Railroad
New York State Thruway Authority

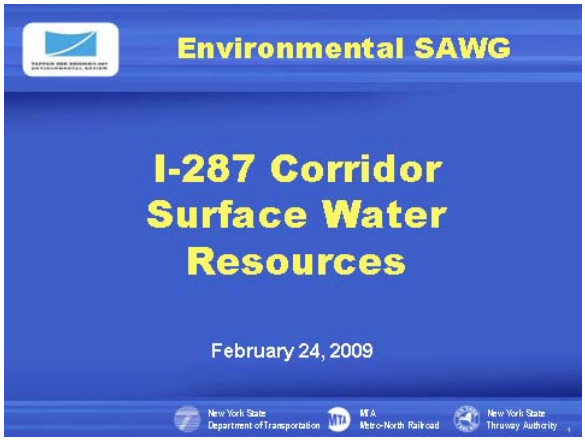
Presenation

Stakeholders' Advisory Working Groups (SAWGs)
Environmental SAWG Meeting #9

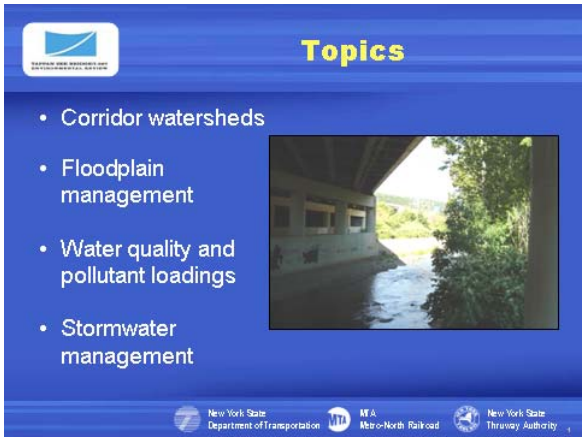
Tappan Zee Bridge/I-287 Corridor
Environmental Review



February 24, 2009

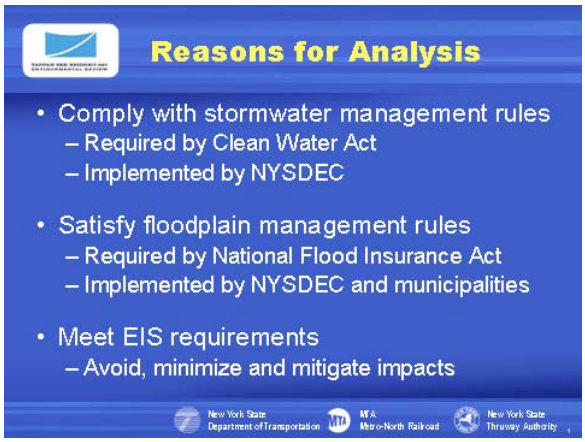


Slide 1



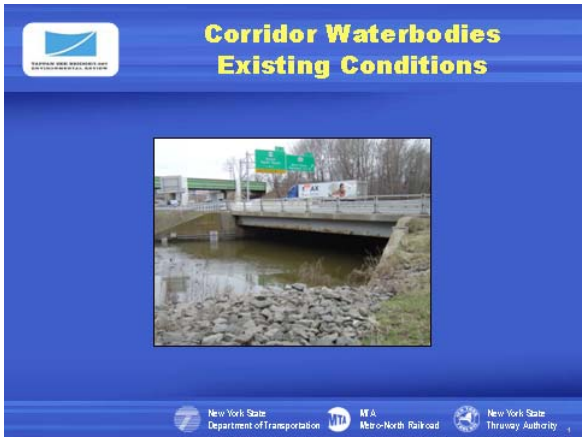
Slide 2

This presentation will address the existing conditions and methods of impact analysis for the various streams and rivers crossed by the I-287 corridor in both Rockland and Westchester counties. Aspects of the project related to the Hudson River crossing have been addressed previously and are not a subject of this presentation. The subjects included in this presentation include a description of the existing conditions of corridor waterbodies and their watersheds, floodplain management analyses, water quality and pollutant loading analyses, and stormwater management requirements.



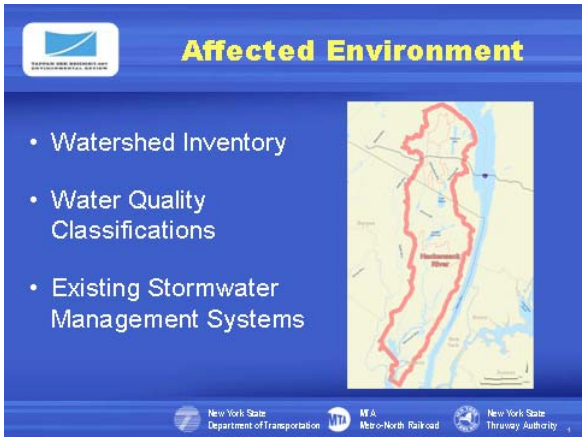
Slide 3

There are various reasons for the analyses that will be described in this presentation. Among these are two regulatory requirements that must be satisfied for permitting processes: the state's stormwater and floodplain management rules (both Federal programs that are implemented at the state level by the NYSDEC) have specific requirements about building within existing floodplains and the management of stormwater runoff from new projects that must be integrated into the project design. In addition, these analyses assist with meeting the needs of the EIS, in which any potential impacts to the environment, and means of avoiding, minimizing or mitigating them, must be identified.



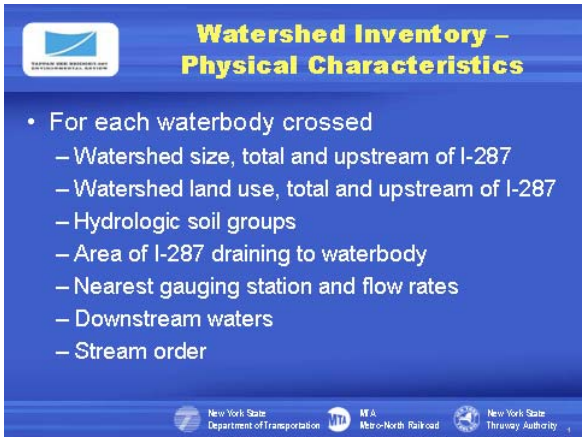
Slide 4

The first step in assessing any potential project impacts to the corridor waterbodies is to determine the existing conditions of the waterbodies and their watersheds. The I-287 crossing of the Hackensack River, one of the corridor waterbodies, is shown here.



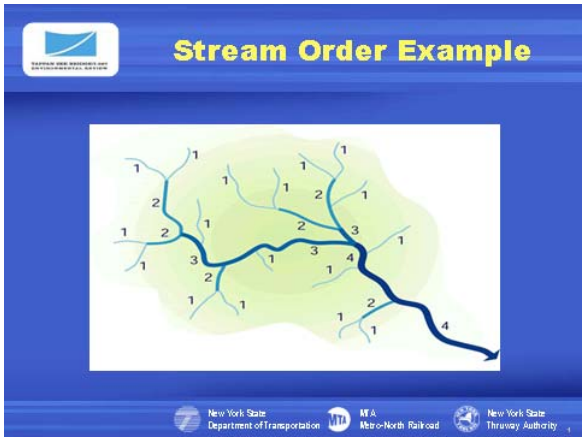
Slide 5

Existing conditions in the "Affected Environment" (i.e., areas where the project could potentially have an impact) are documented by investigating three aspects of the streams and rivers in the corridor. First, a physical inventory of each waterbody and its watershed is conducted (e.g., collection of data on watershed sizes, land uses in the watershed, etc.). Second, water quality classifications are determined for each waterbody. Finally, stormwater management systems along I-287, as they currently exist, are documented.



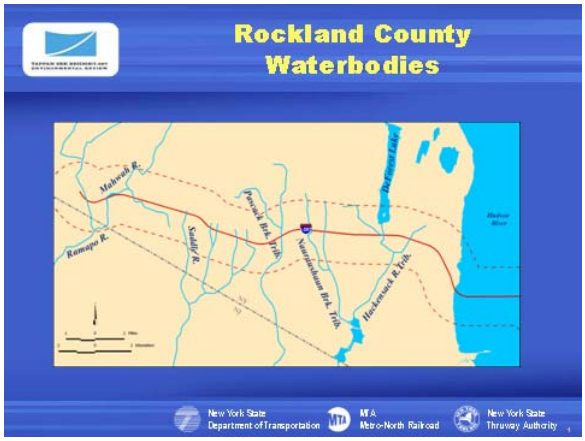
Slide 6

The watershed inventory collects information about each waterbody and its watershed. The watershed's size and land use within the watershed is collected for each waterbody, for both the entire watershed and those portions upstream of the I-287 crossing. Hydrologic soil groups ranging from A (most freely draining) to D (least freely draining) are collected for the underlying soils within each watershed. The surface area of I-287 draining to each waterbody is also identified. The locations of any stream gauging stations, and available flow data from those gauges, are gathered. Where waterbodies crossed by I-287 merge into other waters, any downstream waters between I-287 and final discharge to Newark Bay, the Hudson River or Long Island Sound are identified. Finally, stream order (as described on the following slide) is determined for each waterbody.



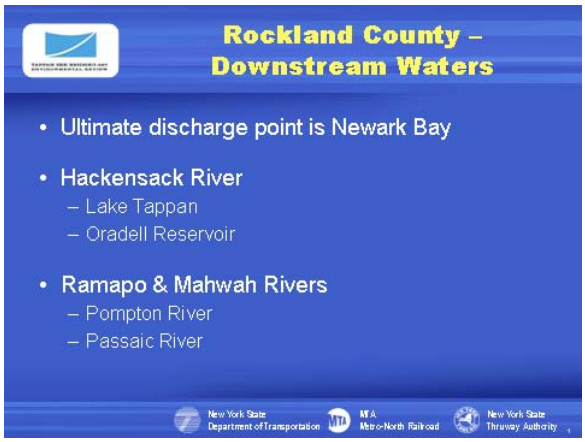
Slide 7

Stream order is the measure of a stream's relative size. A first-order stream is the smallest and typically is shown as a thin blue line on USGS maps. When two streams of the same order merge, the downstream waterbody increases by one order. For example, two first-order streams combine to create a second-order stream and two third-order streams combine to form a fourth-order stream. When two streams of different orders converge, the stream order does not increase. So, where a second-order stream joins a third-order stream, the downstream waterbody remains a third-order stream.



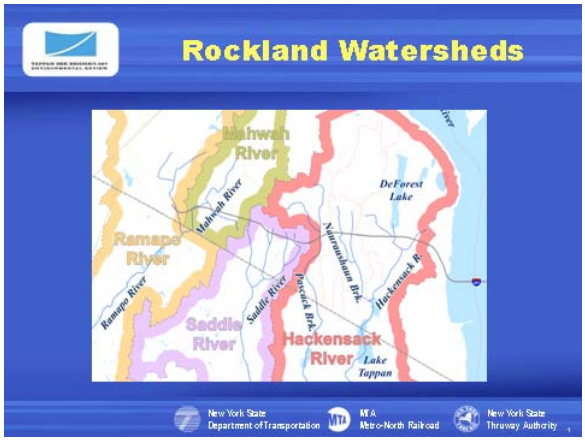
Slide 8

The waterbodies crossed by I-287 in Rockland County include, from west to east, the Ramapo River, the Mahwah River and some of its tributaries, several branches of the Saddle River, the Pascack Brook, two branches of the Nauraushaun Brook and the Hackensack River and one its tributaries.



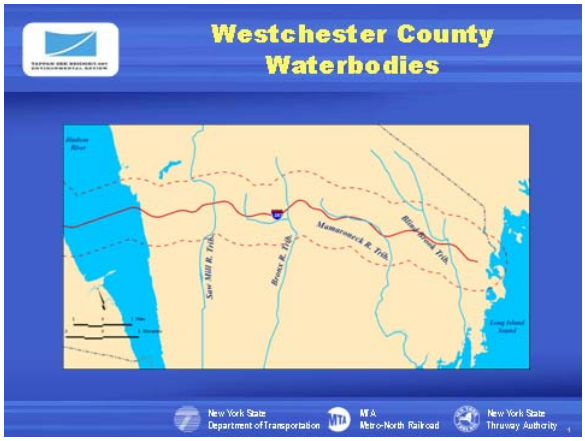
Slide 9

The streams crossed by I-287 Rockland County ultimately converge in one form or another with either the Hackensack or Passaic Rivers and discharge to Newark Bay. Some of the downstream waterbodies encountered along the Hackensack River include Lake Tappan and the Oradell Reservoir. The Ramapo and Mahwah Rivers converge just outside of the study area and ultimately become part of the Pompton River and, later, the Passaic River.



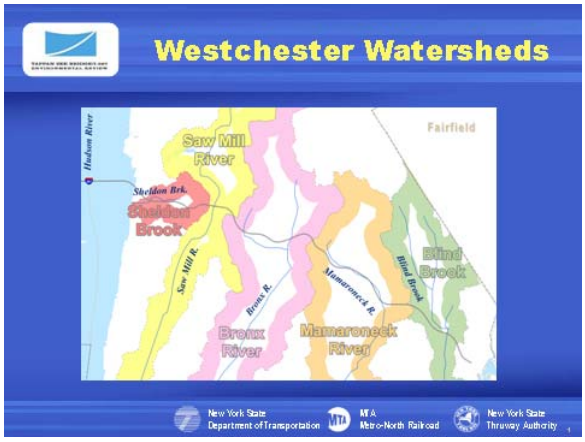
Slide 10

The thick, colored lines in this illustration represent the major watersheds in Rockland County . The similarly-colored thin lines depict the boundaries of the smaller "subwatersheds" for the smaller waterbodies that ultimately converge into the main river.



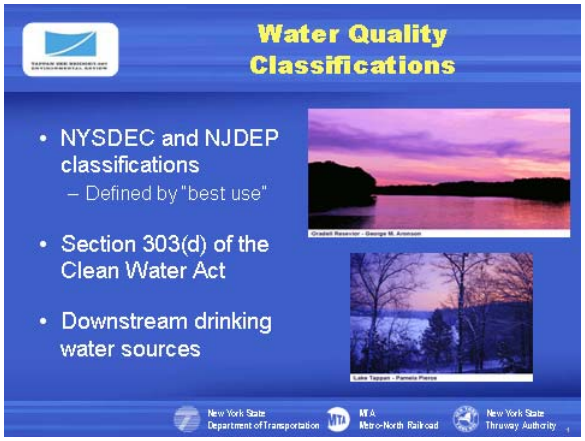
Slide 11

The waterbodies crossed by I-287 in Westchester County include, from west to east, Sheldon Brook and a tributary, the Saw Mill River, a tributary to the Bronx River, the Bronx River, the Mamaroneck River and several of its tributaries, and the Blind Brook.



Slide 12

The thick, colored lines in this illustration represent the major watersheds in Westchester County . Unlike in Rockland County, in Westchester County I-287 crosses the main stem or tributaries of streams and rivers that discharge directly to the Hudson River or the Long Island Sound, so there is no inventory of "downstream waterbodies."



Slide 13

Water quality classifications are collected as part of the inventory process.. Both the NYSDEC and the NJDEP classify waters within the states according to their "best use," as defined by the physical characteristics of each waterbody. Stream segments at or downstream of I-287 that are considered "impaired" under Section 303(d) of the Clean Water Act (CWA) are also identified. Finally, waters used as a source of drinking water downstream of I-287 are identified.

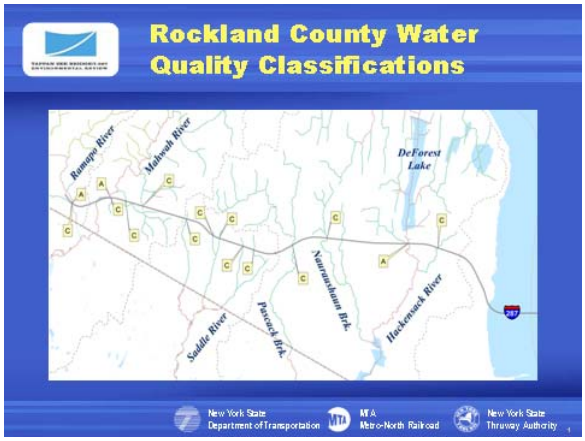
Pictures courtesy of: http://www.bergenswan.org/

Slide 14

The NYSDEC splits its surface water classifications into two broad categories, fresh waters and saline waters. In both cases, waters are rated from a scale of A (widest use) to D (narrowest use). Each classification shown here also includes the uses identified for lower classes. So, for example, Class A waters are suitable for use not only as drinking water sources but also for primary and secondary contact recreation (Class B uses) and fishing (Class C&D uses).

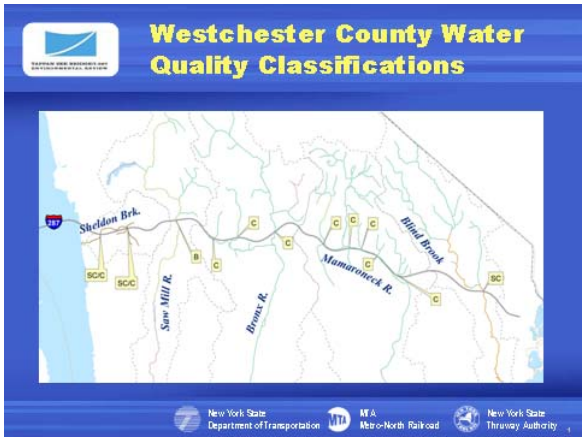
Slide 15

The NJDEP also splits its surface water classifications by fresh and saline waters. For fresh waters, FW1 waters are those waters which are to be preserved in their natural state due to their aesthetic or ecological importance. FW2 waters are fresh waters which may be subject to man-made disturbances (such as withdrawals for drinking water, industrial use, etc.). For saline waters, class SE is assigned to estuarine (inland) waters, with class SE1 representing the widest use and SE3 the narrowest. Class SC applies to all coastal waters in New Jersey.



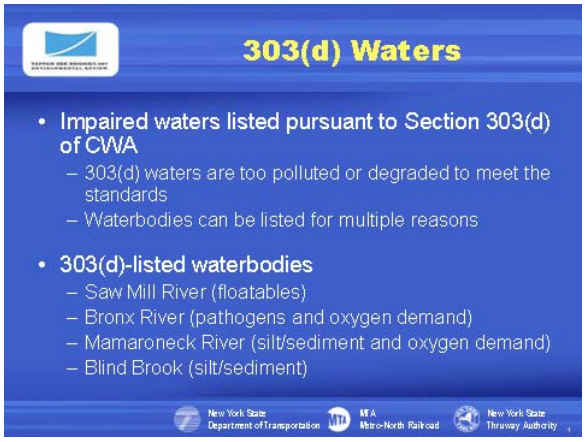
Slide 16

With limited exceptions, the waterbodies crossed by I-287 in Rockland County are listed by the NYSDEC as Class C waters. The exceptions include the main stems of the Ramapo, Mahwah and Hackensack Rivers, which are listed as Class A waters.



Slide 17

With limited exceptions, the waterbodies crossed by I-287 in Westchester County are listed by the NYSDEC as Class C waters. The exceptions include Sheldon Brook and its tributaries, which are listed as Class SC/C (a hybrid used when the limits of the saline water are not defined); the Saw Mill River, which is listed as Class B water; and the Blind Brook, which is listed as a Class SC water.



Slide 18

As noted previously, waterbodies that cannot fulfill their designated best use are listed as "impaired waters" under Section 303(d) of the CWA. I-287 crosses four 303(d)-listed waters, all in Westchester County. According to the NYSDEC, in all four cases the sources of the pollutants causing the noted impairments have been determined to be urban stormwater runoff.

Slide 19

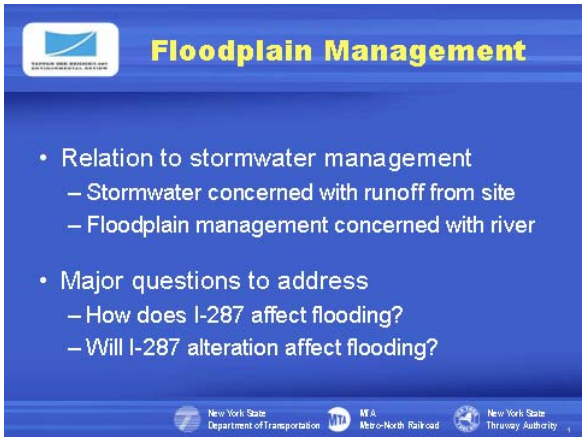
For 303(d) waters, the state must consider whether it is necessary to implement restrictions on discharges to those waters in order to address pollution issues. These restrictions are implemented by TMDLs, which set the maximum load of pollutants that may be discharged. These limits are passed on to dischargers through more restrictive limits in their SPDES permits. The only TMDL waterbody in the I-287 study area is the Long Island Sound, which has a TMDL for nitrogen. Nitrogen is a nutrient that encourages algae growth, resulting in reduced oxygen in the Sound. Many wastewater treatment plants were required to install more advanced treatment technologies in order to meet the decreased nitrogen discharge limits.

Slide 20

In Rockland County, I-287 is typically drained by roadside swales, which carry stormwater to the nearest stream. There are a few areas where runoff is taken from the roadway in storm drains (often referred to as "hard" or "closed" drainage) and then piped to a stream. These closed systems are generally short, although there is a 3,500-ft length of closed drainage near Airmont Road and a 4,500-ft stretch of closed drainage between Interchange 10 and the Hudson River. Highway drainage in Westchester County is more complex and is still being evaluated.

Slide 21

Floodplain management analyses will be used to assess the severity of flooding in waterbodies crossed by I-287, and potentially to identify constrictions causing recurrent flooding.

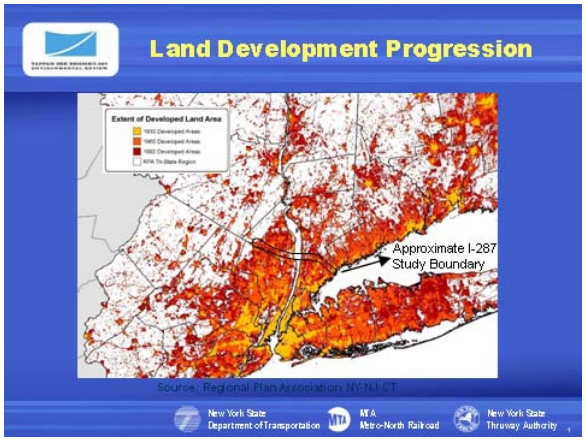


Slide 22

Stormwater management controls the runoff from the impervious surfaces of I-287. The floodplain management portion is concerned with how the I-287 structures may impact the flooding of the river.

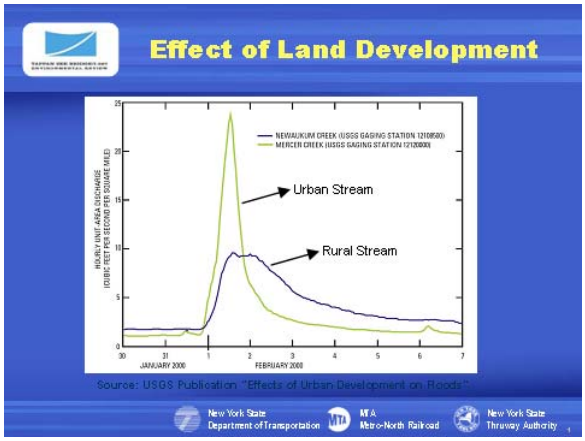
Slide 23

There are known problem areas in Rockland and Westchester Counties where frequent flooding occurs. Homes and businesses and other developments were built in floodplain areas, often before the formal definition of floodplains by FEMA . Impervious surfaces associated with development reduce infiltration, thus creating more runoff, and increase flow rates in water bodies.



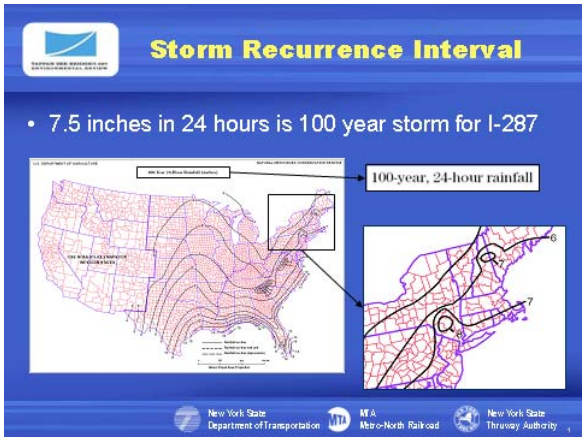
Slide 24

This graphic shows the expansion of developed areas in the region over time, with the lighter colors reflecting long-standing development and the darker areas reflective of more recent development. Much of the development in the I-287 study area has occurred in the post-1960 timeframe.



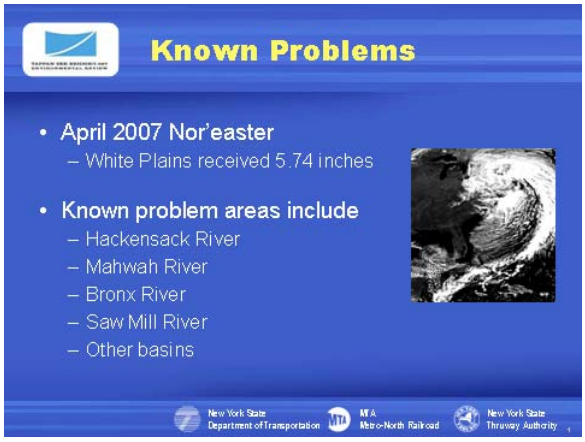
Slide 25

The graphic shows two similar streams very close to each other geographically, although they are not in the study area. The stream represented by the green line has an urbanized watershed. The stream represented by the blue line has an undeveloped watershed. Impervious surfaces and piped drainage systems create both greater volumes of water and also faster concentrations of water, resulting in greater peak flows. This is demonstrated in the recorded flow rates of the two streams, where the urban stream has a larger peak flow rate.



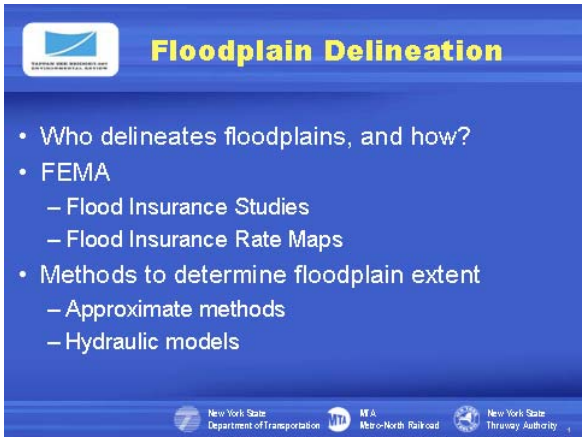
Slide 26

Another important concept for floodplain management is the storm recurrence interval. A storm that is expected to occur once every 100 years is the 100-year storm. Across the I-287 corridor, a 100-year storm is expected to have about 7.5 inches of rainfall in 24 hours.



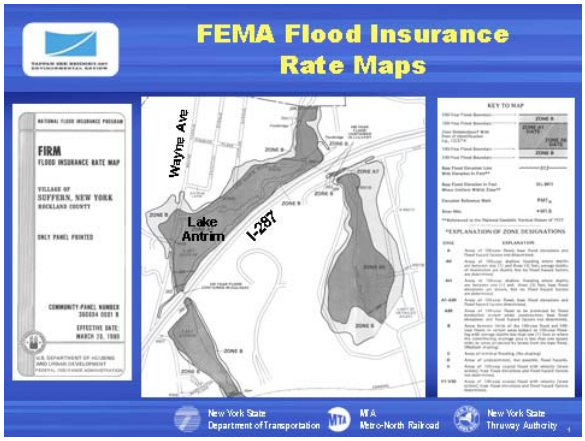
Slide 27

There are several known problems areas near the I-287 corridor related to flooding. The recent April 2007 Nor'easter was a particularly devastating storm for the region. Rain gauges across the region recorded different rainfall rates but generally were between five and seven inches.



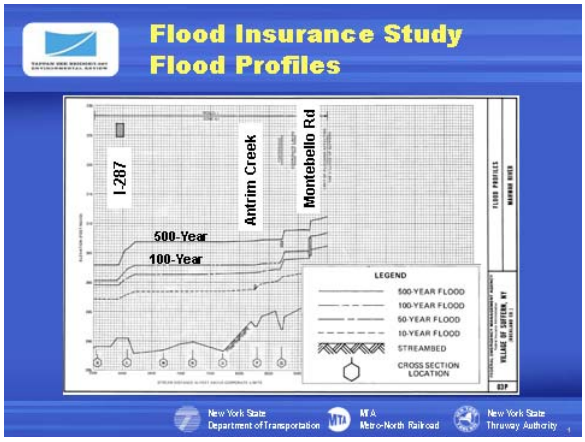
Slide 28

Another important aspect of floodplain management is the delineation of floodplains. This is generally done by FEMA in their Flood Insurance Studies, which produce Flood Insurance Rate Maps that show the expected boundary of the floodplain. Multiple methods are used to determine the extent of the floodplain; detailed hydraulic models are considered the most accurate.



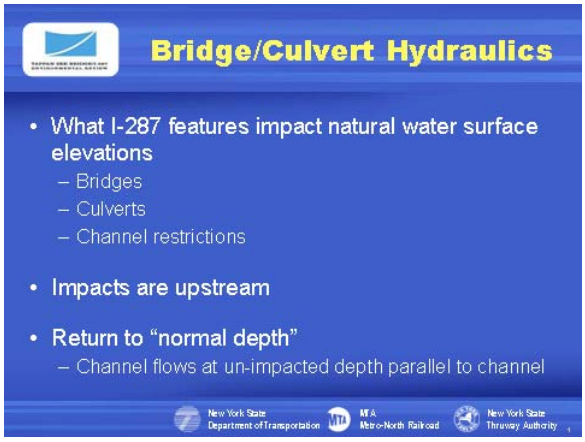
Slide 29

This is an example of a Flood Insurance Rate Map for the Mahwah River near the I-287 corridor.



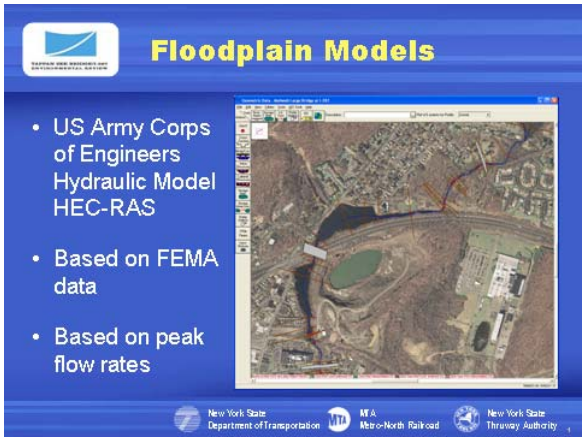
Slide 30

In additional to the Flood Insurance Rate Maps, flood profiles are produced which show the channel bottom, landmarks along the river such as bridges and waterbodies, and the depth of the 500-, 100-, 50- and 10-year floods.



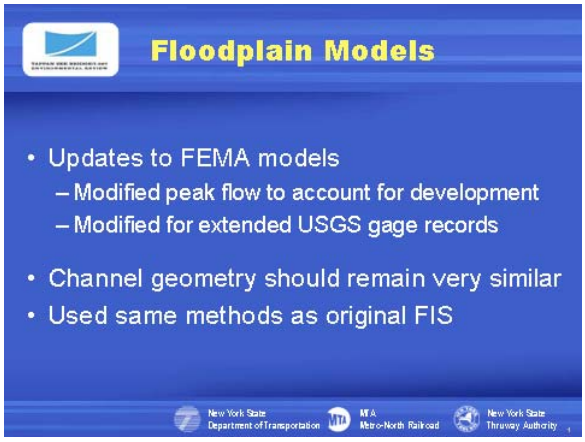
Slide 31

When a structure is placed over or in a water body, it restricts the flow by reducing the natural area of the flow path to the structure size. When this happens the water surface elevation upstream is increased. As you travel upstream from the structure, the effect is reduced until the waterbody essentially returns to its "normal depth."



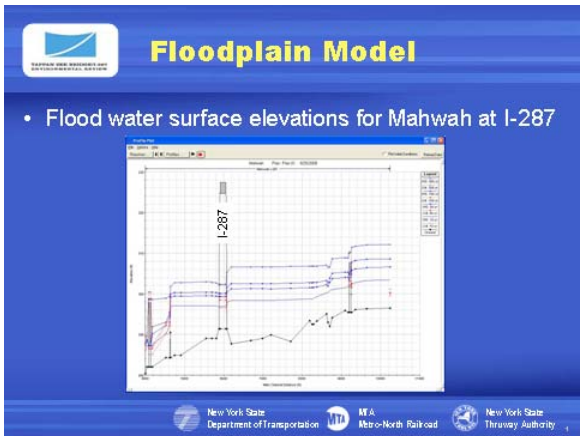
Slide 32

As part of the analysis, we are able to re-create the FEMA floodplain models to evaluate project impacts. Even though a variety of flow rates occur during a flood event, the floodplain delineation is based only on the peak flow.



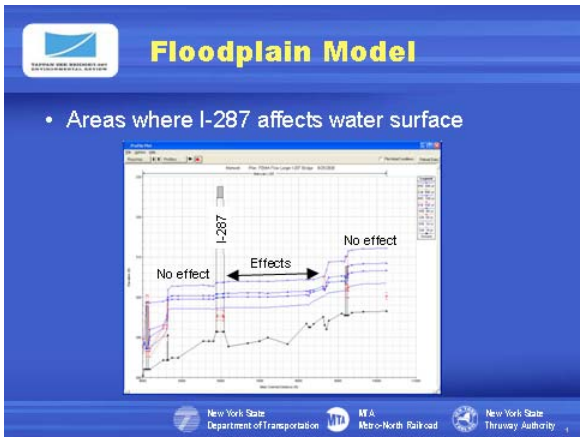
Slide 33

Many current FEMA models are from the 1980's and may be outdated. For the purposes of this project, key existing FEMA models are being updated. The original FISs used population estimates to calculate increased flow rates in developed areas. Peak flow rates at gage stations (e.g., 30 years of peak yearly flow data) can be used to predict the peak flow rate in a 50-year or 100-year storm. If either population or gage records have been updated, predicted flow rates may be affected.



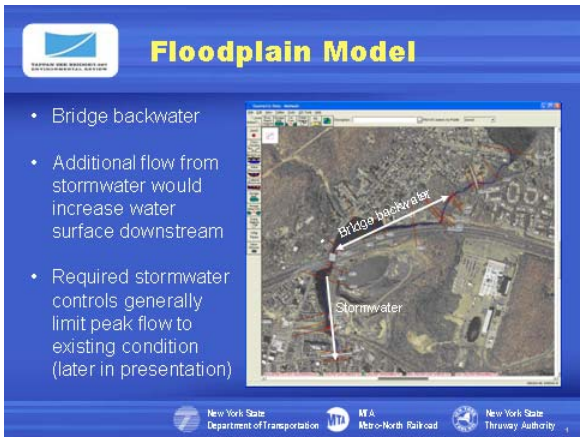
Slide 34

This is the output of the hydraulic model for the Mahwah River near I-287, which is very similar to the flood profiles shown in the FIS.



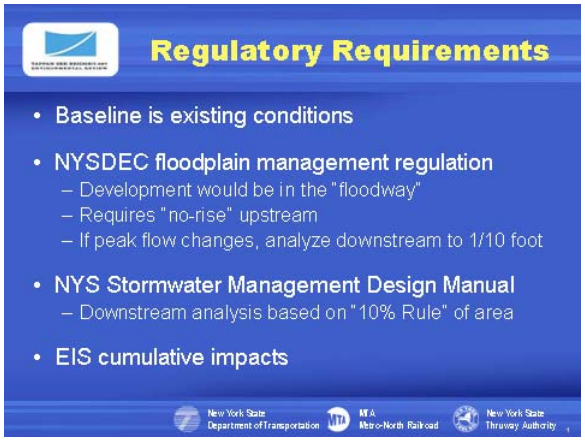
Slide 35

Using the model to analyze the floodplain, the approximate area in which I-287's structures create a backwater can be determined. The length of the river under the "Effects" label identifies the portion of the river where the flood elevation is affected by the structure at I-287.



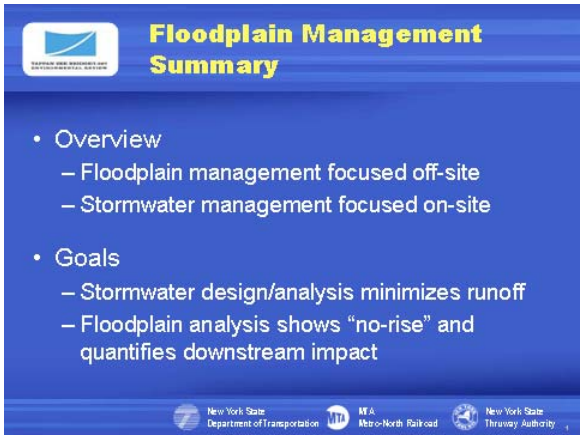
Slide 36

The approximate extent of the bridge backwater (the "Effects" area shown on the previous graphic) is shown in plan view in this model graphic and occurs upstream of I-287. An increase in flow rate from stormwater runoff from I-287 has the potential to affect flood elevations downstream, if not mitigated.



Slide 37

If peak flow changes, the effect must be analyzed downstream until the proposed condition meets the existing condition to within 1/10 of a foot. The "10% Rule" states that an increase in flow rate from a site should be analyzed downstream to a point for which the area of the proposed development is less than 10% of the area of the watershed upstream of that point.

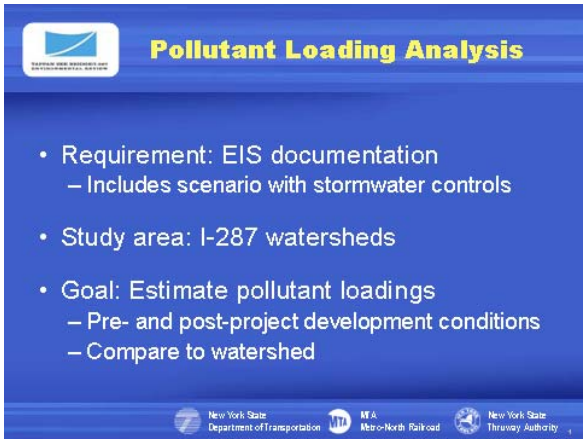


Slide 38

In summary, the floodplain management analyses are focused on structures (bridges/culverts) that may cause flooding off site. The impacts of stormwater runoff from I-287 itself on flood elevations are addressed separately. The goals of the stormwater management program are to minimize or eliminate increases in stormwater runoff from I-287. The goal of the floodplain management analysis is to understand the effect of I-287 on flooding and show that no rise in flood elevations are expected upstream of I-287.

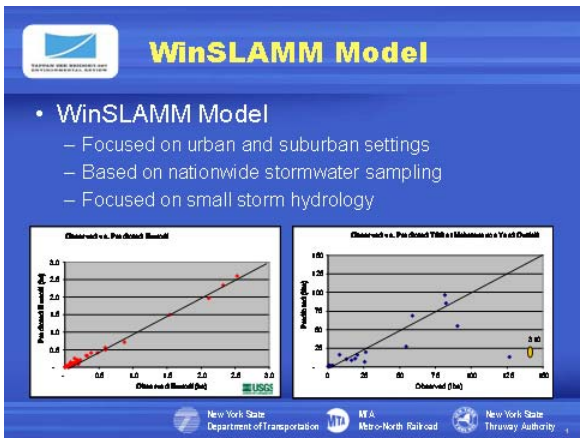
Slide 39

Pollutant loading analyses will be conducted to assess the existing conditions of corridor waterbodies due to both I-287 and development upstream of I-287 at water crossings, and quantify any change in these pollutant loadings as a result of the project.



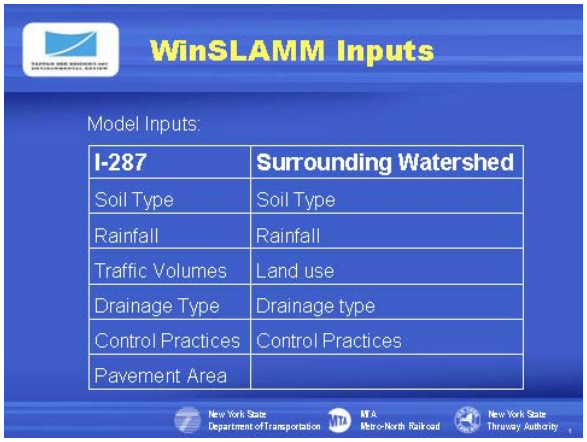
Slide 40

The analysis of pollutant loadings is necessary to document what, if any, impact to corridor waterbodies will occur as a result of project development. Stormwater management facilities constructed as part of the project will be included in the assessment of pollutant loadings. The goal of the program is to estimate pollutant loadings from I-287 as it currently exists and from the proposed development for the purposes of comparison of project alternatives, as well as a comparison of pollutant loadings from I-287 against the loadings from the watersheds as a whole.



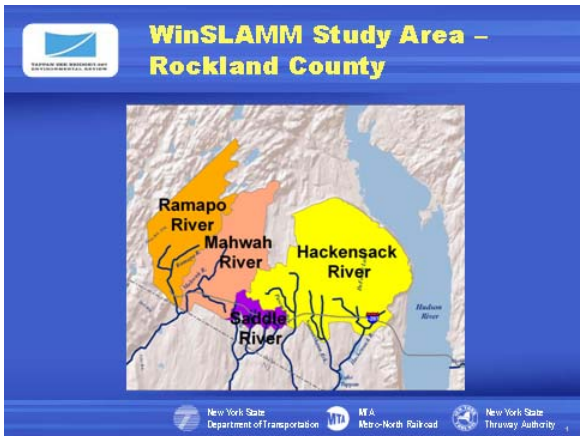
Slide 41

The "WinSLAMM" computer model, which is focused on urban and suburban settings, will be used to estimate pollutant loadings. Most pollutant loading happens during the smaller, everyday-type storms. These graphics illustrate the results of stormwater sampling at a specific site.



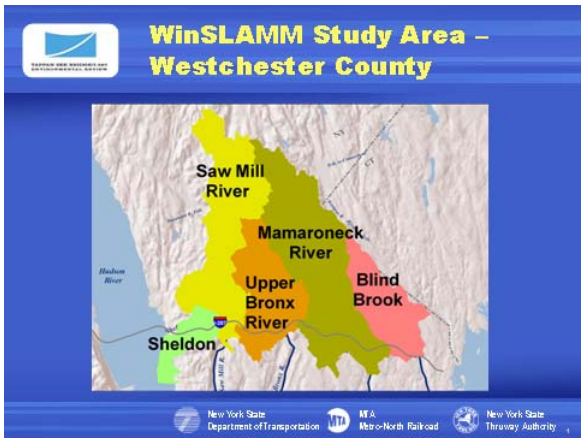
Slide 42

The data necessary for the WinSLAMM analyses of I-287 and the surrounding watershed are similar, though the analysis of I-287 itself will take into account specific, detailed information about the usage of the road.



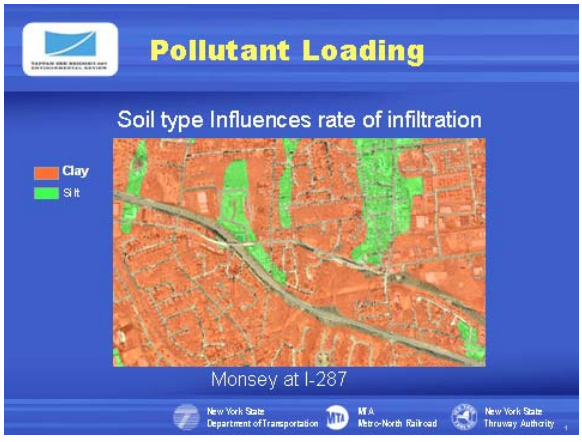
Slide 43

These are the approximate boundaries of the pollutant loading analysis for the watersheds used in the WinSLAMM analyses.



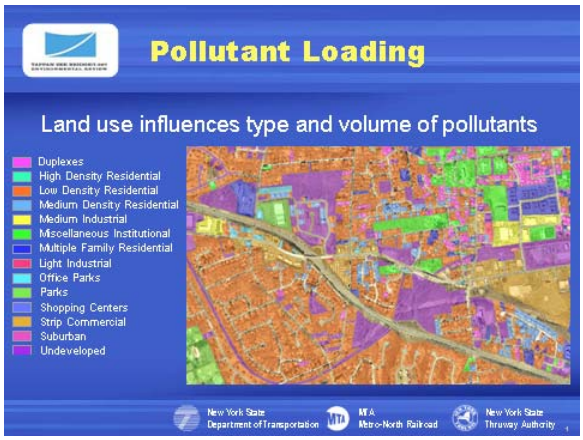
Slide 44

These are the approximate boundaries of the pollutant loading analysis for the watersheds used in the WinSLAMM analyses.



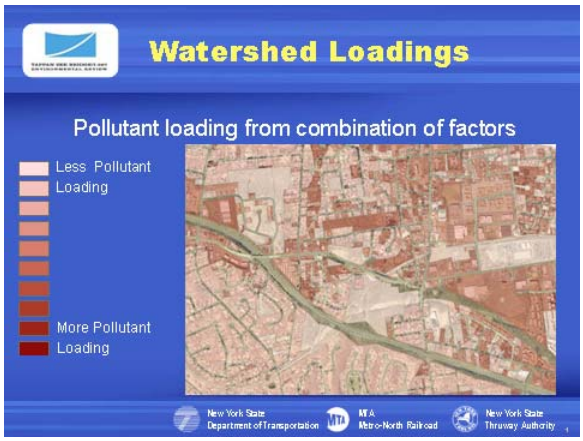
Slide 45

This is an example of the type of information that is used in the model. This graphic represents the distribution of soil types within the model area. Soil type is an input to the model because stormwater runoff occurs at different rates depending on the underlying soil type. For example, typically, less runoff will occur in sandy areas, while more will occur in clayey areas.



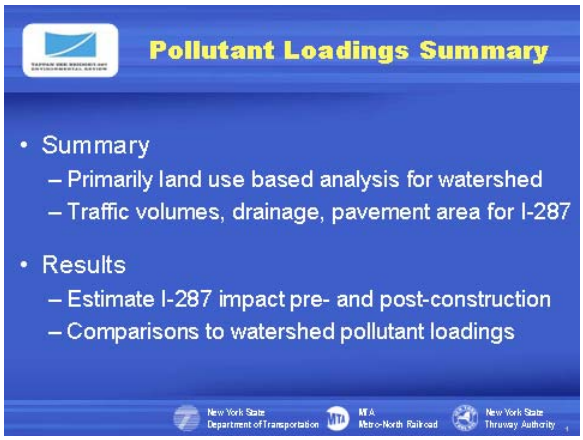
Slide 46

This is another example of the type of information that is used in the model. This graphic shows the distribution of the different land uses within the study area. Land use is an important factor and is used to determine the type and quantity of pollutants that come from a specific area.



Slide 47

The combination of the model inputs leads to an approximate pollutant loading from each area. Lighter-colored areas in this graphic are representative of areas contributing relatively less pollutants, while the darker areas are representative of areas contributing relatively more pollutants.



Slide 48

The analysis will provide a comparison of pollutant loadings from I-287 both pre- and post-construction, as well as the relative size of those loadings compared to those in the upstream watershed.

Slide 49

Stormwater management analyses are concerned with the collection and management of stormwater runoff from I-287 itself.

Slide 50

The NYSDEC has issued "General Permits" to control stormwater runoff from three main types of dischargers. General Permits set the minimum standards that these dischargers must meet, as an alternative to issuing individual discharge permits for every property discharging stormwater. Site owners certify their compliance with the permit regulations by submitting a "Notice of Intent." If a Notice of Intent has not been submitted, then stormwater discharges from the site are not permitted.

Slide 51

An MS4 must comply with the permit depending on the population density of its service area; in the case of the I-287 study area, the entire corridor is within areas where compliance with the permit is mandatory. Whether a site must comply with the industrial permit depends on site use; however, if a site is subject to both the industrial MS4 permits, the MS4 permit controls. For example, while the NYSDOT, NYSTA and Metro-North all have sites that would require compliance with the industrial permit, because they are also MS4s the MS4 permit governs.

Slide 52

The construction permit will control design of new facilities for the I-287 project. Under the construction permit, the project design must consider not only the impacts of stormwater runoff from the site during the construction phase but also stormwater runoff from the completed project.

Slide 53

A SWPPP is the document that shows how a construction project complies with the construction permit. All SWPPPs must show how runoff is controlled during construction, in the form of a Sediment & Erosion Control Plan. Most SWPPPs (including SWPPPs for the I-287 project) must also show compliance with requirements for the completed project. If permit requirements cannot be met, the SWPPP must justify any requests for variances from the rules, which are reviewed by local and/or state officials. The NYSDOT and NYSDEC have an agreement that simplifies the process for some variances, but the NYSDOT must always comply with the rules to the "maximum extent practicable."

Slide 54

The basic principles of a Sediment & Erosion Control Plan are to first prevent erosion from occurring, and secondly to contain any erosion that does occur before stormwater runoff leaves the site. Sediment & Erosion Control Plans will typically have several stages to reflect changing needs for sediment and erosion control as project construction evolves.

Slide 55

Means of preventing erosion include limiting the size of active work areas, stabilizing exposed areas using temporary mulching or seeding, or use of methods such as rolls or mats to cover disturbed areas. The photo on the left shows the application of temporary seeding using the hydroseeding technique. The photo on the right shows a typical installation of an erosion control mat .

Slide 56

Once erosion occurs, sediment must be removed from stormwater runoff before it leaves the site. Usually, this is accomplished by slowing the flow of water, so that sediment can settle out. The photo on the left is an example of a check dam that can be placed in a swale. The water slows as it hits the dam; sediment settles out in front of the dam, and clean water flows over. The photo on the right is of a sediment trap, which can be used for larger quantities of runoff. Essentially, this is a big sedimentation basin that significantly slows the runoff flow, allowing sediment to settle out before the stormwater reaches the discharge point seen in the background.

Slide 57

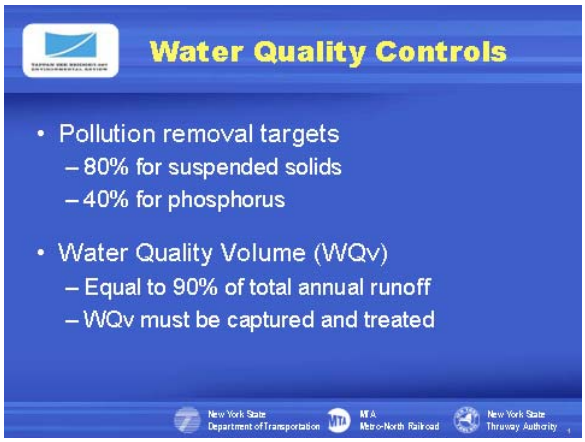
Linear methods are often used to control stormwater runoff at site boundaries. Silt fences, shown on the left, are a typical measure constructed of geotextile spread between posts and used as a barrier to sediment flow. Straw bales, shown on the right, function in a similar way. They are not preferred for large, long-duration construction projects because they are not as durable or as functional as silt fences, but are a measure many are familiar since they are prevalent at smaller construction sites.

Slide 58

Best Management Practices (BMPs) to eliminate or reduce the discharge of pollutants from construction sites to waterbodiesare also used at site exit points. A stabilized construction entrance (shown in photo at left) is used to ensure sediment is not carried away on the tires of vehicles as they leave the site. Drainage inlet protection (shown on the right) is often installed in the form of a silt fence placed around drains that are in the middle of areas where construction has not yet finished. The silt fence prevents sediment from washing into the storm drain.

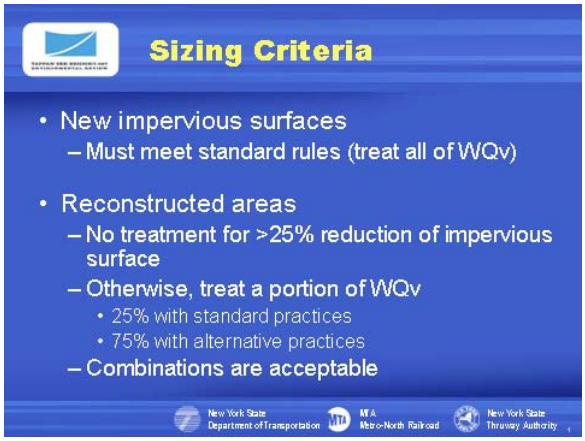
Slide 59

Most sites must also install permanent measures to control stormwater after construction is complete. The objective of these controls are two-fold: water quality controls help prevent the degradation of stream water quality, and quantity controls help prevent the worsening of downstream flooding. "Standard practices" are methods that use natural processes to control water quality and are automatically recognized by the NYSDEC as meeting the pollution removal targets if properly sized. Most engineered practices are referred to as "alternative practices," which cannot ordinarily satisfy the requirements of the stormwater regulations as a stand-alone installation.



Slide 60

The goals of water quality controls, as defined in the standards, are to remove 80% of the suspended solids and 40% of the phosphorus in the stormwater before it is discharged from the site. As previously noted, much of the pollution from stormwater runoff is carried off by frequent, small storms. The NYSDEC has established a sizing formula that determines a "Water Quality Volume" (or WQv) for each site. Measures sized for the WQv will capture 90% of the total runoff from a site over the course of a year by targeting these smaller, frequent storms.



Slide 61

For new development, the entire WQv must be captured and treated. For reconstruction of previously uncontrolled sites, however, the NYSDEC recognizes that applying the rules for new construction would be impractical. NYSDEC has developed alternative sizing criteria that allow for treatment of only a portion of the WQv, depending on the treatment method employed.

Slide 62

Stormwater ponds, an example of a standard practice, work by capturing the entire WQv and discharging it slowly, so that pollution can be removed by both settlement of solids and biological activity as the water comes in contact with plant life. There is always some water in a stormwater pond (known as a "permanent pool"), which helps slow down the early phases of runoff so that proper treatment still occurs.

Slide 63

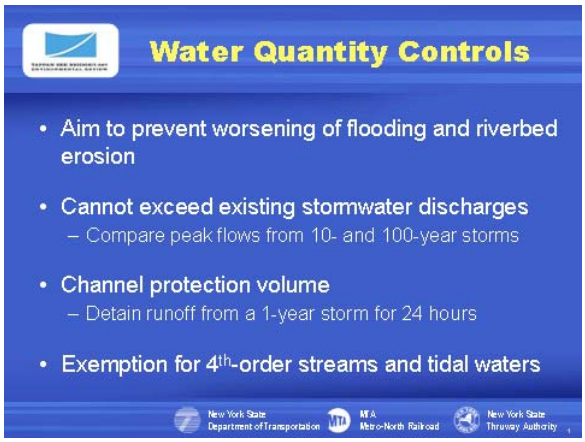
Stormwater wetlands are another example of a standard practice. They are similar to stormwater ponds except that wetland vegetation is added. There is a permanent pool to slow down stormwater flow, and pollution is removed through both settlement of solids and biological activity as the water comes in contact with plant life.

Slide 64

Infiltration trenches are another standard practice. They are essentially "containers" in the ground that collect stormwater and dissipate it into the surrounding soil. The areas in which infiltration trenches are applicable are not as wide-ranging as those for stormwater ponds and wetlands because there are often issues that prevent sufficient flow of water into the soil, such as the presence of groundwater, rock, or relatively impermeable soils (such as clay).

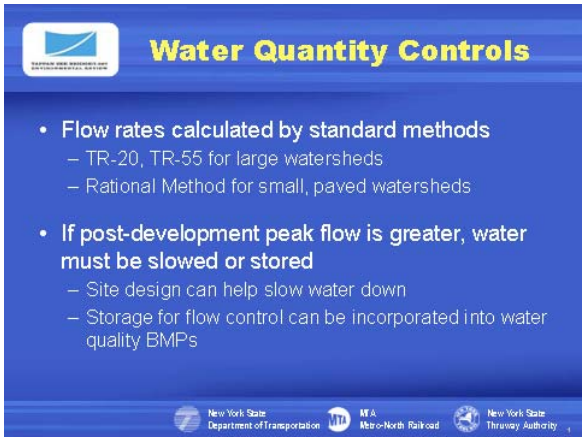
Slide 65

Hydrodynamic separators are an example of an engineered solution that can significantly reduce the land area required for water quality treatment. However, they are an alternative practice, meaning that they may not be applicable as a stand-alone solution without a variance (depending on site conditions). The hydrodynamic separator works by first creating a whirlpool in a swirl chamber, which helps to draw suspended solids out of the stormwater. Then, a series of baffles help trap oil, grease and other floating items before the stormwater is discharged.



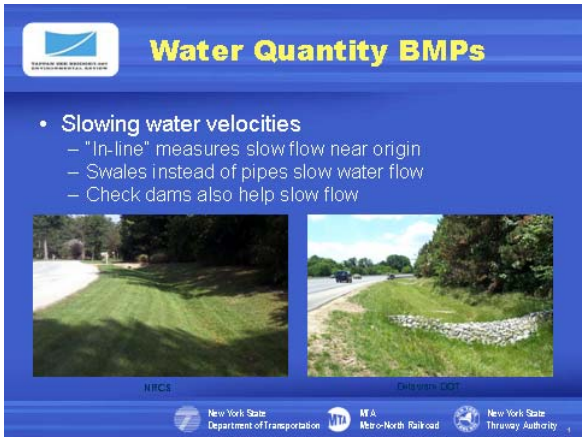
Slide 66

Water quantity controls aim to prevent the worsening of downstream flooding during large rain events and also to prevent the erosion of existing riverbeds. The quantity control rules prevent the worsening of downstream flooding by limiting the peak flow of stormwater runoff from the developed site to the existing flows before construction. Sites discharging to 4th-order or larger streams or tidal waters do not need to comply with these requirements. The channel protection criteria slow down stormwater flow to prevent riverbed erosion by detaining the total runoff from a 1-year stormand discharging it slowly.



Slide 67

Standard, accepted engineering methods are used to determine both existing and predicted peak stormwater runoff rates from the site. If the predicted post-development flow rates are higher, then altered site design and/or storage facilities are used to reduce the discharge to the receiving stream.



Slide 68

Alternative site design methods can help slow down stormwater flow near the source. For example, stormwater runoff will generally flow more slowly through open drainage systems such as swales (shown in the photo to the left) than it will through closed systems, such as piped storm drains. Check dams (shown in the photo to the right) can also be used to further slow the flow of stormwater in a swale. Slowing the flow of water helps reduce peak flow, since it now takes longer for all of the runoff to reach the discharge point.

Slide 69

Storage, often provided by detention basins, controls peak discharges by collecting stormwater and then releasing it in a controlled manner. Quantity control storage is often accomplished by oversizing stormwater ponds or wetlands to provide the additional required storage, as seen in the stormwater pond in the photo to the left. When water quality control is provided by other means, a dry pond (as seen in the photo to the right) can be used for storage.

Slide 70

At sites where space for conventional storage methods is not available, it is sometimes feasible to create below-ground storage vaults by installing large pipes or span structures (as shown in the photos to the left and right, respectively), which then discharge accumulated water in a controlled manner. However, the placement of in-ground structures such as those pictured here often limits what the overlying land can be used for. For example, while these measures are often employed beneath parking lots, they are not typically compatible with mainline roadways, such as an interstate.

Slide 71

The construction permit will generally govern the design of stormwater management facilities for the I-287 project. During construction, the primary goal is to prevent erosion from disturbed areas and then trap eroded sediment before it reaches a stream. Permanent controls will be required to control stormwater after construction is complete. For water quality controls, natural processes are preferred, although the targeted use of engineered solutions can help where sites are constrained. Water quantity control is implemented first by attempting to slow the flow of stormwater, and then by storing excess water so that downstream flooding is not worsened.

Slide 72