Amtrak® ENGINEERING

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STORMWATER MANAGEMENT POLICY

Scope

This specification is for designing stormwater management drainage facilities on property adjacent to Amtrak's Right-of-Way. These requirements are closely allied with the needs associated with the safety of high speed rail passenger service.

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1. Introduction

1.1. This specification has been developed to outline the National Railroad Passenger Corporation's (Amtrak) policies, criteria, and methodologies regarding hydrologic/hydraulic design of proposed developments adjacent to the Amtrak's right-of-way.

1.2. Reference to this specification will provide definitive guidelines for preparing thorough hydrologic/hydraulic design analyses in conformance with the requirements of Amtrak's Engineering Practices, Amtrak's Specification 63, and as specified herein. Close adherence to the provisions of this specification will reduce the review process time for hydrologic/hydraulics approval.

2. Policy

2.1. Amtrak reserves the right to review any development adjacent to the Amtrak ROW or facilities to ensure that: 1) the proposed development will not adversely affect the railroad and 2) improvements on Amtrak's land are in conformance with Amtrak's design criteria, construction specifications, and standard details.

2.2. Adverse impacts may include flooding, erosion, structural damage, and/or any safety hazard that may occur.

2.3. All submittals must be sent to Amtrak's Director of I & C Projects. The Director of I & C Projects will review the development plans and computations to confirm that:

- All inlets, pipes, channels and other storm drain facilities constructed on Amtrak's property meet Amtrak criteria.
- The hydraulic design of proposed drainage facilities, which connect directly to Amtrak drainage facilities either upstream or downstream, are adequate.
- On-site drainage systems for proposed developments, which do not connect directly to Amtrak drainage facilities, will not indirectly result in an adverse impact to Amtrak facilities or ROW.
- Proposed improvements do not create safety or erosion hazards.
- Work within or adjacent to Amtrak does not cause an increases in flow or total runoff towards the railroad.

2.4. Amtrak's approval will not be issued until a complete set of final plans and computations as specified in these criteria has been received and reviewed.

2.5. These plans and computations must also be reviewed and approved by the local stormwater management-approving agency (town, city, county, state, etc.). Amtrak is not an approving agency for stormwater management facilities.

2.6. All storm water facilities must be designed to accommodate a storm with a 100 year recurrence interval as determined by using either the Soil Conservation Service (SCS) or the Rational Method, whichever is appropriate.

2.7. The applicant must also supply Amtrak with copies of all of the other approvals that are required for the proposed development; e.g., Non-Tidal Wetland and Waterway Permits, Tidal Wetlands License, Army Corps of Engineers Permits, Point Discharge Permits etc.

2.8. Computations must be provided that demonstrate that discharge from the proposed development for storm intervals of a 2; 5; 10; 25; and 100 year storms does not raise the existing flood water levels on the railroad property.

2.9. All storm water retention or detention facilities constructed up-gradient of the Amtrak right of way that may pose a risk to train operations must be constructed, inspected and maintained in accordance with the latest edition of the United States Department of Agriculture, Soil Conservation Service - Technical Release 60. Impoundment structures shall be considered a Class "C" dam. Relief from this requirement can only be obtained by submission of a letter from the appropriate State agency that regulates dam safety stating that Technical Release 60 does not apply at this specific location. The State agency must then dictate the classification of the proposed structure and the level of inspection and maintenance required.

Amtrak does not consider the United States Department of Agriculture Natural Resources Conservation Service – Conservation Practice Standard – Pond No - Code 378 to be applicable unless it is dictated as noted above. Code 378 clearly states the following:

"CONDITIONS WHERE PRACTICE APPLIES
This standard establishes the minimum acceptable quality for the design and construction of low hazard (class "a") ponds if:

1. Failure of the dam **will not** result **in loss of life**; damage to homes, commercial or industrial buildings, main highways, or **railroads**; or in interruption of the use or service of public utilities."

2.10. Most importantly, Amtrak's review or lack of review does not release the owner, developer or their consultant from liability.

3. Submittal Requirements

3.1. The following material (if appropriate) shall be submitted for hydrologic/hydraulic review by Amtrak:

1. County approved stormwater management (SWM) plans and computations or documentation from the County regarding their waiver of SWM.

2. Pre-development drainage area map for the entire watershed, clearly indicating the existing contours both on site and off site. (1"=200' scale or larger)

3. Post-development drainage area map for the entire watershed, clearly indicating the proposed contours both on site and off site. (l"=200' scale or larger)

4. A set of the latest approved post-development site plans, clearly indicating existing topographical features, proposed structure details, typical sections, pipe profiles, and contour grading.

5. Complete storm drainage plan and hydraulic gradient profiles of both the existing and proposed storm drainage system from the proposed development for storm intervals of 2; 5; 10; 25; and 100 year.

6. Complete hydraulic analyses for cross-culverts under Amtrak for the 100-year storm utilizing the Soil Conservation Service (SCS) Method.

7. Complete storm sewer design computations for proposed closed storm drainage system for the 100-year storm utilizing the Rational Method.

8. Complete hydraulic gradient computations for proposed and existing storm drainage systems for the 100-year storm, utilizing the Rational Method.

9. Complete analyses, utilizing the SCS Method, for:

    a. Channels adjacent to the Amtrak ROW for the 100-year storm.

    b. Inlet / outlet channels to culverts for the 100-year storm.

10. Complete hydrologic analysis/back-up data (eg.: t_c, t_c path, curve numbers, soil types, TR-20 Schematic Diagrams, land uses, etc.).

3.2. The following standard programs can be used for the design computations:

- Culvert Analysis or HY-8 Computer Analysis
- Peak Discharge using TR-55 *or* TR-20 Computer Analysis
- Rational or Modified Rational Methods may be used for areas less then 20 acres.
- Alternative methods required by local governing or regulating authorities, provided they are more restrictive then the above and use the 100 year storm event as the design standard.

3.3. Calculation shall be provided to show the derivation of the Runoff Curve Number (RCN) for the TR - 20 computer input forms. Supplementary computations sheets showing the derivation of "times of concentration" (t_c) must also be submitted. TR-55 worksheets may be used to show these computations.

3.4. All computations are to be neatly prepared, well organized, and appropriately labeled so they can be easily reviewed. The computations shall also include references to all design charts and publications used in the preparation of the computations.

3.5. The pre- and post-development drainage area information shall include:

- An outline of the total drainage area to the point being analyzed and all sub-areas within the total watershed that are pertinent to the computations. The drainage area shall not be limited to the development site.
- The soil types within the watershed.
- The land uses within the watershed.
- All time-of-concentration (t_c) flow paths investigated, showing the limits of overland flow, swale flow, ditch flow, pipe flow, stream flow, etc. The chosen path shall be clearly differentiated from all other paths investigated. When the t_c path changes with the recurrence interval, each path must be clearly identified.
- Existing and proposed storm drain and stormwater management systems (both on site and off site) serving the development and surrounding watershed.
- Drainage area and cross section numbers that agree with the design computations and computer output data.

4. Methodology

4.1. The following methods shall be used in performing hydrologic computations for development projects that are to be reviewed by Amtrak.

1. The "United States Soil Conservation Service Hydrograph Method", utilizing either the TR-55 Tabular Hydrograph Method or the TR-20 program, shall be used for determining the discharges for design and analysis of culverts, SWM facilities, and open channels.
2. The Graphical Peak Discharge Method may be used only when development is within a homogeneous watershed (watershed subdivision not required), and reservoir routing is not required.
3. The Rational Method shall be used for determining the discharges for design and analysis of closed drainage systems (those consisting of pipes and similar structures). The Rational Method may also be used for areas of 20 acres or less. The Rational Method is defined by the following equation:

   $Q=CiA$ Where :
   Q - peak flow (cfs).
   C - dimensionless runoff coefficient.
   i - rainfall intensity (in/hr).
   A - catchment area (acres).
4. Alternative methods that may be required by local governing or regulating authorities, provided they are more restrictive then the above and use the 100 year storm event as the design standard.

5. Hydrology

5.1. The hydrologic computations shall be performed in conformance with the Methodology noted in Section 4 above for the site and as specified herein.

5.2. The following analyses may be required depending on the resulting adequacy of the drainage facilities:

1. Pre-development (existing).

2. Post-development analysis for the project site with full potential development in accordance with existing zoning for the site. Should this analysis demonstrate adequacy of the existing and/or proposed drainage facilities, no further analysis is required.

5.3. The entire watershed to the point of investigation is to be included in the hydrologic computations.

5.4. The latest available version of TR-55 or TR-20 is to be used in determining runoff by the Soil Conservation Service Method unless a different method is allowed by the provisions of paragraph 3.2 above. The standard SCS 24 hr. Type II rainfall distribution (Table #2) is to be used for the TR-20 program. The selection of sub-areas and cross sections for the reach routings for development of composite hydrographs shall be suitably justified and documented.

5.5. The applicant shall determine a representative time of concentration based upon land use, slopes, and soil groups. Several paths should be investigated in the process and the path representing the greatest contribution of runoff chosen (the most representative time is not necessarily the longest time). All flow paths shall be indicated on the drainage area maps and supported by backup computations.

5.6. Special considerations in unique circumstances may require other additional methods of analysis. Contact with the Amtrak's Director of I & C Projects is recommended when the designer is considering special cases.

6. Culvert Analyses

6.1. The applicant shall provide an analysis for all proposed culverts under Amtrak and for all existing culverts that may be affected as a result of the proposed development. This may include culverts that are located beyond the property boundaries. These analyses shall include a review of the stability/capacity of the downstream channel and design of outfall protection measures.

6.2. Definition of a culvert: Any culvert under the railroad with or without a headwall, end section or protective end, whose primary function is to convey off-site runoff through the railroad, is considered to be a culvert. This definition applies even if an extended downstream storm drainage system is connected to the culvert. In addition, an entrance culvert parallel to the railroad with a downstream storm drainage system connected to it may also be considered a culvert. In these cases, a hydraulic gradient based upon the SCS methodology discharges will be required to determine the tailwater for the upstream culvert.

6.3. The headwater pool elevation for the design flood must not be higher than the bottom of the railroad tie based upon the proposed development and existing conditions for the off site portion of the watershed. The bottom of the railroad tie is approximately 1.43 feet below the top of the rail.

6.4. The post-development headwater pool elevations shall be determined taking into consideration the following:

- Storage at the inlet of the culvert if appropriate.
- Overflow into or from an adjacent drainage basin.
- Tailwater elevations from downstream drainage, headwater pools, floodplains, and storm-water management facilities.
- Extension of the culvert to accommodate railroad embankment widening.
- Outflow from upstream storm-water management facilities.

6.5. Storm drain extensions that are proposed downstream of an existing culvert under Amtrak shall be adequately sized to handle the ultimate development of the watershed, as allowed by zoning, regardless of the capacity of the culvert. The plans must include profiles of all proposed culvert extensions.

6.6. Any development adjacent to an Amtrak facility must ensure that an existing flooding problem on the Amtrak facility will not be worsened as a result of the proposed development. In the event of increased discharges, applicants may (subject to county and state approval) upgrade or supplement an existing culvert to reduce the runoff to pre-development levels or below. Adequacy of the outfall must be addressed should this option be pursued. Should this prove to be infeasible, a storm-water management facility may be required.

6.7. Headwalls shall be provided on pipes. All culverts must have a minimum diameter of 18 inches for a length of less then 60 feet and 24 inches for a length of 60 feet or greater. As with all drainage design, railroad safety and stability is paramount in considering the location of culvert headwalls and end sections.

6.8. With any other special circumstance, coordination with Amtrak Engineering is recommended.

7. Off-site Drainage Design

7.1. All proposed development adjacent to Amtrak shall include a storm drainage system along Amtrak's property that will intercept existing and proposed flows and discharge the system in accordance with Amtrak criteria. Waivers to this policy must be reviewed and approved by Amtrak Engineering.

7.2. The applicant shall prepare a pre- and post-development analysis for watercourses when runoff from the proposed development is directed toward the Amtrak property. Additional detention or diversion will be required if the peak discharge (cfs) from the development increases.

7.3. The applicant shall utilize one of the following options if Amtrak's review finds that an adequate drainage system has not been specified:

1. Provide additional inlet capacity;
   and/or

2. Revise the site plan to reduce runoff to Amtrak. This may include re-grading for the proposed development and/or additional inlets or detention on-site.

8. Closed Storm Drainage Systems

8.1. The applicant shall provide an analysis for all existing and proposed storm drainage systems under or adjacent to Amtrak which may be affected as a result of the proposed development. This frequently includes systems that are located beyond the property boundaries.

8.2. The 100-year post development storm, utilizing the Rational Method, shall be used for storm drainage pipe designs. Pipes should be initially sized to convey this discharge at or below full flow.

8.3. The submittal for review shall include the following:

- Plans, profiles and construction methods for the proposed system to meet the design requirements of Amtrak's EP 3005- Pipeline Occupancy – Specification 02081A.
- Completed Storm Sewer Design for the 100-year storm frequency.
- Hydraulic gradient computations for a 100-year storm. This must be plotted on the pipe profiles and be below the top of grate or manhole cover.

8.4. Channel conditions downstream from the storm drain outlet pipe and/or the Hydraulic Grade Line (HGL) of an existing downstream storm drain shall be carefully reviewed to determine the beginning elevation for the hydraulic gradient computations. Additionally, when a proposed system is directed toward a stormwater management facility, the 100-year water surface elevation must be used as the controlling tailwater elevation. A complete discussion of assumptions and backup computations shall be provided.

8.5. The 100-year storm hydraulic gradient shall be developed for the proposed storm drainage systems for post-development conditions to determine if flooding of the Railroad is exacerbated by the post development runoff. An analysis of the existing system must be performed to determine if flooding occurs or worsens as a result of the proposed development. If so, appropriate design revisions must be made.

8.6. The surface overflow flood route shall be plotted for all projects for the pre- and post-development conditions to identify potential flooding hazards.

8.7. General design requirements for designing pipes within the Amtrak ROW are found in Amtrak's Engineering Practice EP 3005 – "Pipeline Occupancy – Specification 02081A

9. Open Channels

9.1. The applicant shall provide an analysis for all proposed channels adjacent to Amtrak and any existing channel that may be affected as a result of the proposed development. This may include channels that are located beyond the property boundaries. All proposed channels are to be designed such that no adverse impact to the Railroad occurs.

9.2. The water surface elevations for new open channels for a 100-year frequency storm shall be at least 1 in. below the bottom of the railroad tie elevation.

9.3. Open channels shall be checked for velocity, depth of flow and type of lining for the design storm including locations in the channel where:

- Other swales and ditches outlet into the channel
- The typical section of the channel changes significantly (eg: the channel changes from a “vee” section to a trapezoidal section, the bottom width increases 2 feet or more, etc.). No “vee” ditches will be permitted on railroad property.
- The grade of the channel changes (either flattens or steepens)

9.4. Specific items, that the design and analysis of the channels must include are:

- Depth limitations as stated above.
- All channels must have linings, which will not erode at design velocities.
- Tributary channels shall be designed to intersect the railroad side ditch at an angle of between 30° and 60°.
- Ditches must not change percent of grade in close proximity to headwalls or end sections. Changes in slopes at these locations may cause undermining or clogging of the structure, due to changes in velocity, and are therefore not allowed.

10. Stormwater Management (SWM)

10.1. SWM approval is the responsibility of the local approving agency. Amtrak is not an approving agency for SWM facilities. Amtrak is solely concerned with potential impacts to Amtrak facilities due to inadequate SWM.

10.2. The applicant shall provide complete design computations and construction plans for all proposed SWM facilities that are adjacent to Amtrak. All SWM facilities are to be designed or analyzed with the SCS Hydrograph Method. No other methods will be allowed. The SCS "Short-cut Method" is not acceptable. The SWM computations shall address the appropriate pre- and post-development discharge rates. In addition, computations based on the functional storm may be required so that Amtrak can perform a complete evaluation of the development. All soils data (soil type, runoff coefficient, etc) for water quality management shall be included with the SWM computations.

10.3. All SWM facilities for private development must be located outside Amtrak property.

10.4. The following should be considered when designing SWM facilities:

- Ponds downstream of railroad facilities must be adequately sized so that the hydraulic operation of upstream drainage systems for the railroad is not impacted.
- Emergency spillways directing flow onto Amtrak will not be allowed. The emergency spillway must discharge flow away from Amtrak or into an adequate channel where flow will not impact railroad operations.
- All detention facility designs must comply with the requirements contained in the Soil Conservation Service Publication TR – 60
- All dams adjacent to and upstream of Amtrak are to be Class "C" per TR-60 unless as determined in paragraph 2.9 above.
- A breach routing plan is required. A breach routing plan must route water away from Amtrak.
- Use of existing Amtrak SWM, such as detention basins, facilities by private applicants is not allowed.