City of Albany Stormwater Local Design Manual

Engineering Department

Revised December 2025

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1. FORWARD

This Stormwater Local Design Manual (LDM) is meant to serve as a comprehensive guide to implementing stormwater management systems in the City of Albany (City). Additionally, the LDM is designed to supplement the Georgia Stormwater Management Manual (GSMM), current edition, which shall serve as the technical reference manual for design and specification of individual components within the system. No design measures are included in this LDM for the protection of trout waters since no trout waters are present in the City of Albany.

1.1. Meeting the City's Stormwater Management Requirements

The following steps outline the process for developing and permitting a stormwater management plan.

Pre-Design Phase

Step 1. Check for new special district requirements with City staff
Step 2. Check for concept plan submittal requirements
Step 3. Prepare concept plan (if required)
Step 4. Submit concept plan to City and schedule concept plan meeting (if required)
Step 5. Meet with City staff to discuss concept plan (if required)

Design Phase

Step 6. Prepare stormwater management plan
Step 7. Submit stormwater management plan to City for approval
Step 8. Execute stormwater maintenance agreement for all private onsite stormwater management facilities.

Construction Phase

Step 9. After receiving City approval, coordinate construction with City inspection staff
Step 10. Begin construction

Post Construction Phase

Step 11. After construction, prepare As-Built Survey and As-Built Design Certification
Step 12. Adjust stormwater structures if necessary
Step 13. Secure Certificate of Occupancy/Final Plat

2. GENERAL LEVEL OF SERVICE STANDARDS

2.1. Retention & Detention Requirements

2.1.1. Discharge Rates from New Development Projects including Linear Transportation Projects

Development plans including site grading and drainage plans should be developed to minimize disruption of natural drainage patterns on properties, as well as to minimize impacts to downstream drainage infrastructure and structures. Whenever a Hydrologic & Hydraulic Report (as defined in Section 7 of this document) indicates a potentially adverse impact resulting from development of a property on a downstream property, that project shall incorporate stormwater detention facilities to reduce the discharge rate. The meaning of adverse impact shall apply to situations where the post-development discharge rates, up to and including the 100-year storm event, exceed those determined for the pre-developed conditions. Additionally, no increases in stormwater runoff rates shall be allowed at any discharge point from the site unless approved by the City.

The stormwater management system shall be consistent with the requirements set forth in the Georgia Stormwater Management Manual, latest edition. The amount of stormwater runoff reduction needed to satisfy the stormwater runoff reduction criteria, known as the runoff reduction volume (RR_v), can be calculated by multiplying the depth of rainfall generated by the target runoff reduction rainfall event by the site area and a volumetric runoff coefficient (Rv):

The following formula should be used to determine runoff reduction volume (RR_v):

$$RR_v = \frac{(P)(R_v)(A)}{12}$$

Where,
RR_v = Runoff Reduction Volume in cubic feet
P = Target runoff reduction rainfall, 1.0 inch.
A = Total drainage area in square feet.
R_v = Volumetric runoff coefficient [0.05 + 0.009(I)], where I is percent of impervious surface (impervious area ÷ total project area) x 100.

For all areas in the City, the target runoff reduction (P), is 1.0 inch.

The stormwater management system shall be designed to retain the 1.0-inch runoff reduction volume on the site, to the maximum extent practicable. The determination by the City that it is infeasible to apply the stormwater runoff quality/reduction standard, on part or all of a project, must be documented with the site plan review documents. If the 1.0-inch runoff reduction volume can be retained onsite, then additional water quality treatment is not required. If the 1.0-inch runoff reduction volume cannot be retained onsite, the remaining runoff from a 1.2-inch rainfall event must be treated to remove at least 80% of the calculated average annual post-development total suspended solids (TSS) load or equivalent as defined in the GSMM or in the equivalent manual.

Also see Appendix A – Karst Areas. Linear transportation projects and hot spots (see Section 2.3.3) are exempt from the 1.0-inch runoff reduction volume retention requirement; stormwater quality treatment requirements apply to these projects.

The baseline or pre-developed conditions shall be on an analysis of the existing conditions taking into account existing land use, stormwater management controls and other factors that can affect the site's hydrologic responsiveness. Proposed developments shall be analyzed for the following storm events:

- 1.0-inch runoff reduction volume retained on site
- 2-year 24-hour Design Storm
- 5-year 24-hour Design Storm
- 10-year 24-hour Design Storm
- 25-year 24-hour Design Storm
- 50-year 24-hour Design Storm
- 100-year 24-hour Design Storm

If the total site area (i.e. total property area) and the drainage area to each stormwater management facility is less than one acre, then a rainfall intensity-based analysis (i.e. rational method) may be performed. However, if detention facilities are to be designed and constructed in series, the 24-hour storm criteria will apply regardless of the drainage area.

Where downstream conditions indicate that the conveyance and/or storage capacity of existing infrastructure could be impacted by the post development conditions, or where existing structures could be impacted by the post developed conditions, a more stringent standard may be required. For example, if the project site drains into an existing retention/detention pond within the study area, then the designer will be required to demonstrate that the discharge rates from the proposed development will still allow the pond to operate at a level commiserate with the site in an undeveloped state.

Detention facilities should be designed upon the basis of known or projected developments (proposed by the developer) for the contributing drainage basin. Although the developer is only required to construct the facility with sufficient volume to provide detention for the proposed development, a design shall be provided to the City demonstrating the ultimate configuration of the facility at full build-out. Additionally, the proposed site plan should have sufficient land around the facility reserved to construct the ultimate configuration without significant demolition.

2.1.2. Discharge Rates from Redevelopment Projects including Linear Transportation Projects

Development plans including site grading and drainage plans should be developed to minimize disruption of natural drainage patterns on properties as well as to minimize impacts to downstream drainage infrastructure and structures. Whenever a Hydrologic & Hydraulic Report (as defined in Section 7 of the LDM) indicates a potentially adverse impact resulting from development of a property on a downstream property, that project shall incorporate stormwater detention facilities to reduce the discharge rate. The meaning of adverse impact shall apply to situations where the post-development discharge rates, up to and including the 100-year storm event, exceed those determined for the pre-developed conditions. Additionally, no increases in stormwater runoff rates shall be allowed at any discharge point from the site unless approved by the City.

The stormwater management system shall be designed to retain the 1.0-inch runoff reduction volume on the site's redeveloped area, to the maximum extent practicable. The determination by the City that it is infeasible to apply the stormwater runoff quality/reduction standard, on part or all of a project, must be documented with the site plan review documents. If the 1.0-inch runoff reduction volume can be retained onsite using runoff reduction methods, then additional water quality treatment is not required. If the 1.0-inch runoff reduction volume cannot be retained onsite, the remaining runoff from a 1.2-inch rainfall event must be treated to remove at least 80% of the calculated average annual post-development total suspended solids (TSS) load or equivalent as defined in the GSMM or in the equivalent manual. Also see Appendix A – Karst Areas. Linear transportation projects and hot spots (see Section 2.3.3) are exempt from the 1.0-inch runoff reduction volume retention requirement; stormwater quality treatment requirements apply to these projects.

The baseline or pre-developed conditions shall be based on an analysis of the existing conditions taking into account existing land use, stormwater management controls and other factors that can affect the site's hydrologic responsiveness. Proposed developments shall be analyzed for the following storm events:

- 1.0-inch runoff reduction volume retained on site
- 2-year 24-hour Design Storm
- 5-year 24-hour Design Storm
- 10-year 24-hour Design Storm
- 25-year 24-hour Design Storm
- 50-year 24-hour Design Storm
- 100-year 24-hour Design Storm

If the total site area (i.e. total property area) and the drainage area to each stormwater management facility is less than one acre, then a rainfall intensity based analysis (i.e. rational method) may be performed. However, if detention facilities are to be designed and constructed in series, the 24-hour storm criteria will apply regardless of the drainage area.

Where downstream conditions indicate that the conveyance and/or storage capacity of existing infrastructure could be impacted by the post-development conditions, or where existing structures could be impacted by the post-developed conditions, a more stringent standard may be required. For example, if the project site drains into an existing retention/detention pond within the study area, then the designer will be required to demonstrate that the discharge rates from the proposed development will still allow the detention pond to operate at a level commiserate with the site in an undeveloped state.

Detention facilities should be designed upon the basis of known or projected developments (proposed by the developer) for the contributing drainage basin. Although the developer is only required to construct the facility with sufficient volume to provide detention for the proposed development, a design shall be provided to the City demonstrating the ultimate configuration of the facility at full build-out. Additionally, the proposed site plan should have sufficient land around the facility reserved to construct the ultimate configuration without significant demolition.

The following formula should be used to determine runoff reduction volume (RR_v):

$$RR_v = \frac{(P)(R_v)(A)}{12}$$

Where,
RR_v = Runoff Reduction Volume in cubic feet
P = Target runoff reduction rainfall, 1.0 inch.
A = Total drainage area in square feet.
R_v = Volumetric runoff coefficient [0.05 + 0.009(*I*)], where *I* is percent of impervious surface (impervious area ÷ total project area) x 100.

2.2. Conveyance Systems

The following subsections outline the specifications for the stormwater conveyance system's design. In no case shall a drainage system be designed to directly or indirectly discharge stormwater runoff into a sanitary sewer line or system.

2.2.1. Bridges

All bridges shall be designed to accommodate the 100-year 24-hour design storm with the established 100-year flood elevation 1-foot below the low cord of the bridge (i.e. the lowest part of the bridge deck structure or girders whichever is lower).

2.2.2. Culverts & Pipe Systems

The level of service provided by culverts and pipe systems is dependent on a number of different factors. These include the type of road that the system will service, the potential for upstream flooding, floodplain impacts and other service issues. Generally, the required level of service is outlined in the table below:

Roadway Classification / Use	Design Storm
Emergency Access Routes (To be Determined by City)	10-Year
Collector Roadways	10-Year
Local Roads	10-Year
Roads with No Other Outlet	10-Year
Parking Lots / Material Storage Areas / Landscape Areas	10-Year

The level of service standards outlined above are considered minimum standards. Where warranted, the level of service may be increased at the designer's discretion. For determining the maximum allowable head at any structure, the hydraulic grade line (HGL) should be designed to no less than six inches below the inlet elevation (catch basins, yard inlets, drop inlets, hooded grate inlets, etc.). The HGL should be designed to no less than six inches below the rim elevation for all junction boxes. Other inlets such as headwalls, flared end sections, etc. should be designed based on the guidance outlined in Section 2.2.4 of the LDM.

Culverts with contributing drainage areas greater than 25 acres shall be designed to the 25-year 24-hour storm. For example, if a culvert is to be designed to convey stormwater runoff from a 25-acre drainage basin under a neighborhood road, the design storm shall be a 25-year 24-hour storm.

If a culvert is designed to connect to an existing system of a differing design level of service, then the system with the greater design requirement will be used to size the proposed system.

All pipes should be designed to maintain a minimum velocity of three feet per second during the 2-year design storm to promote sediment removal.

2.2.3. Inlets (Catch Basins, Yard Inlets, Drop Inlets, Hooded Grate Inlets and Flumes)

Inlets collecting stormwater runoff from street surfaces and area inlets shall be sized to capture the storm event specified for the pipe system to which it drains and a maximum flooding depth as determined by the following table:

Roadway Classification / Use	Design Storm	Flooding Depth
Emergency Access Routes	10-Year	8.0 ft. Maximum Gutter Spread or Minimum 8.0 ft Lane Width Open
Collector Roads	10-Year	8.0 ft. Maximum Gutter Spread or Minimum 8.0 ft Lane Width Open
Local Roads	10-Year	8.0 ft. Lane Width Open
Roads with No Other Outlet	10-Year	8.0 ft. Lane Width Open
Parking Lots (with a check of the 100-year storm flooding depth and maximum 1-foot depth)	10-Year	Maximum 0.5 ft. Depth
Detention Areas utilized for other purposes with general public access (i.e. parking lot detention, etc.) with flood warning sign	10-Year	Maximum 1.5 ft. Depth
Material Storage Areas / Landscape Areas with flood warning sign if area is utilized by the public (with a check of the 100-year storm flooding depth)	10-Year	Maximum 2.0 ft. Depth

Inlets and grading adjacent to habitable structures shall be designed to prevent stormwater runoff from entering the structure during the 100-year design storm.

In no case shall inlets located on public streets be spaced in excess of 400 feet.

2.2.4. Inlets (Headwalls, Flared End Sections, etc.)

Inlets that utilize the pipe opening as the inlet (i.e. headwalls, flared end sections, etc.) shall be sized to capture the storm event specified for the pipe system to which it drains. The HGL should be designed to be no less than six inches below the edge of pavement or the point at which water would bypass the inlet (i.e. bypass to another inlet, etc.) whichever is less. Additionally, the headwater conditions induced by the inlet should not cause an impact on any upstream drainage structures such that the upstream structure will realize a loss in performance. In simpler terms, the headwater from an inlet should not back water into another culvert or drainage system. This requirement can be waived by the City in situations where it would be infeasible to design the culverts due to proximity of the culverts or extremely shallow grades between the culverts.

2.2.5. Roadside Ditches

Roads constructed without curb and gutter shall incorporate ditches that are designed to the specific design storms. The level of service provided by the ditches shall match the level of service provided by a comparable pipe system as outlined in Section 2.2.2 of the LDM above. The level of service standards are considered minimum standards, where warranted the level of service may be increased at the designer's discretion.

Ditches with contributing drainage areas greater than 25 acres shall be designed to the 25-year 24-hour storm. For example, if a ditch is to be designed to convey stormwater runoff from a 25-acre drainage basin along a neighborhood road, the design storm shall be a 25-year 24-hour storm.

2.2.6. Drainage Channels

For drainage channels designed to convey stormwater runoff either from or to a culvert, the channel should be sized to accommodate the same storm event specified for the pipe system at a minimum. Channels designed to convey stormwater runoff to detention ponds shall be sized to accommodate the 100-year design storm.

2.2.7. Groundwater Dewatering

Sub-drainage will be installed to control the surplus groundwater by intercepting seepage or by lowering or regulating the groundwater level where such conditions exist.

2.2.8. Flood Elevation Impacts

It is the City's policy that raising the elevation of flooding on an adjacent property shall not be acceptable. As such, the level of service standards outlined in Section 2.2 of the LDM shall be considered minimum standards. Where flood elevations on an adjacent property will be increased due to development and/or construction of a drainage system, the level of service may be increased by the City to result in no impact to the adjacent property. This requirement may be waived at the City's discretion if the adjacent property owner provides a permanent drainage easement between the two property owners. The easement shall provide that the owner of the impacted property acknowledges that an increase in flood elevations will occur on their property as a result of the proposed development. Additionally, the easement shall include at a minimum a map showing the extent of the pre-development and post-development 100-year floodplains. Finally, the easement must be recorded with the City as an attachment to the affected property's land deed and shall be binding on all future property owners.

2.3. Stormwater Quality Treatment

2.3.1. Stormwater Quality in New Development

When the 1.0-inch runoff reduction volume is not retained on site (see Section 2.1), stormwater runoff generated from a site shall be adequately treated before discharge. Stormwater management systems must be designed to remove 80% of the average annual post-development total suspended solids (TSS) load and be able to meet any other additional watershed or site-specific water quality requirements. It is presumed that a stormwater management system complies with this performance standard if:

- It is sized to capture and treat the prescribed water quality treatment volume, which is defined as the runoff volume resulting from the first 1.2 inches of rainfall from a site.
- Appropriate structural controls are selected, designed, constructed, and maintained according to the specific criteria in this manual, the GSMM and the Operations & Maintenance schedule developed for the proposed development.

The City encourages the designer to implement specific stormwater credits for reducing the water quality treatment requirements on site. These credits can be found in Section 2.3 of Volume 2 of the 2016 edition of the GSMM. However, the City recognizes that water quality treatment of stormwater runoff from certain areas of a site is infeasible. As such, the following areas are exempt from water quality treatment:

- Portions of the site that lie within City-mandated undisturbed buffers
- Portions of the site that lie within 50 feet of the property line and drain away from the site assuming that no impervious surfaces (including compacted gravel / rock) lie within the 50-foot zone except retaining walls.
- Impervious surfaces associated with the driveway for the first 50 feet as measured from the edge of pavement of the public street to which it connects.
- Portions of the site which will remain undisturbed and which do not drain to a water quality or detention facility/BMP. These undisturbed areas must contain at least 10,000 square feet of contiguous area. Additionally, these areas must not be used for any purposes during construction and must be protected from such activities by construction fencing or other means to prevent construction personnel ingress.
- Linear Transportation Projects – Given the karst topography and underlying limestone formations that extend the full limits of the City, infiltration best management practices are not required for linear transportation projects.

  > "Infiltration BMP's in karst settings have the potential of creating sinkholes as a result of the additional weight of water in a structural BMP (termed hydraulic head) and/or water infiltrated from the BMP that can dissolve the carbonate rock (e.g., limestone)." [*citation is from the publication* *Minnesota Stormwater Manual – Karst* *by the Minnesota Pollution Control Agency at web page* *https://stormwater.pca.state.mn.us/index.php?title=Karst*]
  >
  > "The soluble nature of carbonate geologies makes them sensitive aquifers. Solutions features create an open structure that produces a groundwater regime that provides little in the way of filtration and little resistance to groundwater flow. Cavities in the rock, formed over geologic time lie in wait beneath the surface to open as sinkholes as soil is eroded into the voids. This process can be greatly accelerated by changes to natural drainage and increased or concentrated

infiltration." [*citation is from the publication* *Stormwater Infiltration Practices in Karst* *by Michael J. Byle, P.E., F. ASCE from Proceedings of 2001 Southeastern Pennsylvania Stormwater Management Symposium*]

Additional water quality requirements may be specified for hotspot land uses and activities.

2.3.2. Stormwater Quality in Redevelopment

When the 1.0-inch runoff reduction volume is not retained on site (see Section 2.1), stormwater runoff generated from the site's disturbed area related to redevelopment shall be adequately treated before discharge. Stormwater management systems must be designed to remove 80% of the average annual post-development TSS load and be able to meet any other additional watershed or site-specific water quality requirements.

It is presumed that a stormwater management system complies with this performance standard if:

- It is sized to capture and treat the prescribed water quality treatment volume, which is defined as the runoff volume resulting from the first 1.2 inches of rainfall from a site.
- Appropriate structural controls are selected, designed, constructed, and maintained according to the specific criteria in this manual, the GSMM and the Operations & Maintenance schedule developed for the proposed development.

The City encourages the designer to implement specific stormwater credits for reducing the water quality treatment requirements on site. These credits can be found in Section 2.3 of Volume 2 of the 2016 edition of the GSMM. However, the City recognizes that water quality treatment of stormwater runoff from certain areas of a site is infeasible. As such, the following areas are exempt from water quality treatment:

- Portions of the site that lie within 50 feet of the property line and drain away from the site assuming that no impervious surfaces (including compacted gravel / rock) lie within the 50 foot zone except retaining walls.
- Impervious surfaces associated with any new driveway for the first 50 feet as measured from the edge of pavement of the public street to which it connects.

Additional water quality requirements may be specified for hotspot land uses and activities.

2.3.3. Stormwater Quality Requirements for Hotspot Land Uses

Stormwater hotspots are land uses that often produce higher concentrations of certain pollutants, such as hydrocarbons or heavy metals, that are normally found in urban stormwater runoff. For the purposes of stormwater regulation, the City defines the following land uses/activities as hotspots.

- Gas/Fueling Stations
- Large Parking Lots with Greater than 200 Parking Spaces
- Vehicle Maintenance Areas
- Vehicle Washing/Steam Cleaning
- Auto Recycling Facilities
- Outdoor Material Storage Areas
- Loading and Transfer Areas
- Landfills
- Construction Sites
- Industrial Sites (NPDES Industrial Stormwater Permitted Sites Only)

For the purposes of this regulation, activities that are required to be compliant with National Pollutant Discharge Elimination System (NPDES) Permits issued by the Georgia Environmental Protection Division (EPD) will be considered compliant with the water quality requirements of this section if the requirements for the EPD permit are fully met unless noted below. These activities typically include construction site activities and certain industrial activities. Those sites, which do not meet these exemption criteria, will be required to implement additional requirements.

Gas/fueling stations are required to construct and maintain oil/water separators to collect and treat stormwater runoff from those areas where gas/fuel will be dispensed or loaded to underground and/or above ground storage tanks.

Large parking lots with greater than 200 parking spaces are required to construct and maintain oil/water separators to collect and treat stormwater runoff from those areas where vehicles will be parked.

Vehicle maintenance areas are required to construct and maintain oil/water separators to collect and treat stormwater runoff from those areas where vehicle maintenance will occur and vehicles will be parked awaiting maintenance.

Vehicle washing/steam cleaning areas are required to construct and maintain oil/water/ grit separators to collect and treat stormwater runoff from those areas where washing will occur. Sand filters may be utilized in lieu of oil/water/grit separators with prior approval from the City.

Auto recycling facilities are required to construct and maintain oil/water separators to collect and treat stormwater runoff from those areas where vehicles will be stored, as well as areas where active recycling is occurring.

Outdoor material storage areas are required to construct and maintain sedimentation basins meeting the minimum standards outlined in the Georgia Manual for Sedimentation and Erosion (current edition) to collect and treat stormwater runoff from those areas where materials will be stored.

Loading and transfer areas other than truck docks which shall be considered exempt will be evaluated on a case by case basis. Generally, where the primary concern will be solids transport to nearby streams and drainage structures, the area will be required to construct and maintain sedimentation basins meeting the minimum standards outlined in the Georgia Manual for Sedimentation and Erosion (the Green Book, current edition). If the primary concern will be hydrocarbons and other floatable contaminants, the area will be required to construct and maintain oil/water separators to collect and treat stormwater runoff.

All oil/water separators must be designed to the following criteria:

- Sized to treat the water quality volume
- Designed as an off-line system
- Designed to pre-treat stormwater runoff before entering other water quality BMPs

Water quality peak-flow calculations (consistent with the Georgia Stormwater Management Manual) must be included in the plan review.

Specific oil/water separator information must be provided with the review package. The information can be provided as a separate cut sheet or as a detail included in the construction plans. At a minimum, it must clearly indicate the make and model of the proposed unit as well as its treatment capacity.

2.4. Energy Dissipation

Energy dissipation shall be employed whenever the velocity of flows leaving a new stormwater facility exceeds the erosion velocity of the downstream area.

2.5. Impervious Surface

Impervious surface is defined in Section 54-2 of the City's Stormwater Management Ordinance as *". . . those areas which prevent or impede the infiltration of stormwater into the soil in the manner in which it entered the soil, in natural conditions, prior to development and causes stormwater runoff to collect, concentrate or flow in a manner materially different from what would occur if the land were in an unaltered natural condition. Common impervious surfaces include, but are not limited to, rooftops, buildings or structures, sidewalks, walkways, patio areas, driveways, parking lots, storage areas, awnings and other fabric or plastic coverings, and other surfaces which prevent or impede the natural infiltration of rainfall, or stormwater runoff, which existed prior to development."* Section 54-8 generally states that gravel and compacted soil associated with driveways, parking areas, roads and other areas that consist of these type surface (or near surface) conditions on developed property will be designated as impervious surface and will be calculated at 85 percent.

New or redeveloped impervious areas used in stormwater calculations shall include impervious areas added in the previous 2 years.

3. APPROVED CONSTRUCTION MATERIALS & BMPs

3.1. Conveyance Structures

3.1.1. <u>Pipes within the Public Right-of-Way & Dedicated City Easements</u>

All pipes located within the public right-of-way or dedicated City easements that are accepted by the City for long-term maintenance, shall be constructed of reinforced concrete pipe (RCP – Class 3) meeting Georgia Department of Transportation Standards. All pipes must have a minimum diameter of 18 inches and 12 inches of cover from the exterior crown of the pipe, and in accordance with manufacturer's specifications. Pipes under pavement must have a minimum of 12 inches of cover from the pipe's exterior crown to the bottom of the roadway base.

Outfall pipes, headwalls and associated energy-dissipating measures from private projects will not be allowed in the City's right-of-way.

In situations where the City has reason to suspect that a pipe system may not have been installed properly, the City may require at its discretion, video inspections of pipe systems at the Owner's expense prior to the system's acceptance.

3.1.2. Other Pipe Systems

All other pipe systems not within the public right-of-way, but eventually owned by the City, shall be constructed of reinforced concrete pipe (RCP – Class 3) or HDPE meeting Georgia Department of Transportation Standards. Minimum bedding standards for HDPE pipe shall be such that stone bedding (i.e. No. 57 stone) shall be placed to half of the pipe diameter for all depths and/or in accordance with manufacturer's specifications, whichever is greater. All pipes must have a minimum of 12 inches of cover from the pipe's crown, and in accordance with manufacturer's specifications.

In cases where HDPE pipe originating from private property is joined to RCP in the right-of-way, a transition structure, approved by the City, must be provided at the right-of-way by the Owner.

All pipes must have a minimum of 12 inches of cover from the pipe's exterior crown, and in accordance with manufacturer's specifications. Pipes under pavement must have a minimum of 12 inches of cover from the pipe's exterior crown to the bottom of the roadway base. The minimum cover for pipes, which run along individual lot property lines in residential developments, shall be increased to three feet to account for the potential for damage due to residential fence construction.

In situations where the City has reason to suspect that a pipe system may not have been installed properly, the City may require at its discretion, video inspections of pipe systems at the Owner's expense prior to the system's acceptance.

3.1.3. Channels

All channels with erosive velocities must be protected from erosion through the use of rip-rap, concrete, erosion control matting or similar method acceptable to the City. All channel side slopes shall have a maximum 3-foot horizontal to 1-foot vertical (3:1) slope. Inverts should match at intersections, or the intersection will be designed/modified to accommodate the erosive forces at the transition.

3.1.4. Inlets

All inlets shall be constructed of materials and methods approved by the Georgia Department of Transportation and/or designs pre-approved by the City. Inlet covers (where appropriate) shall be designed and manufactured in accordance with local construction standards related to storm drain stenciling and pollution prevention education. The Owner and/or Designer shall consult the City regarding specific requirements for storm drain covers and inlets.

Headwalls or flared end sections shall be required on inlet and outlet ends of any pipe culvert system.

3.2. Retention/Detention Ponds

All retention and detention facilities constructed in accordance with the requirements of this manual shall be constructed on subdivided parcels deeded to the property owner, or the homeowners association. No retention/detention facility for residential subdivisions shall be constructed in whole or part on a parcel or lot intended for sale to a future resident.

All outlet structures for controlling discharge rates from retention/detention facilities shall be constructed of pre-cast concrete or cast-in-place concrete. The only exception to this rule shall be situations where a pipe is utilized as the primary outlet control. In these situations, the pipe must be protected from scour through the use of a concrete headwall or flared-end-section. Emergency spillways may utilize rip-rap or concrete to prevent erosion if the spillway's invert is set at or above the facility's 100-year maximum stage. Dry detention/retention pond side slopes shall be designed to have a maximum 3-feet horizontal to 1-foot vertical (3:1) slope and provide positive drainage on the pond floor to the pond's outlet.

Ponds shall be designed with a minimum of 1 ft freeboard above the 100-year maximum stage.

A six-foot chain link fence will be required for stormwater retention/detention facilities that exceed six feet in depth measured from the pond bottom to the top of the berm. In the front yard, the fence height may be reduced to four feet. The fence shall include a double drive-through gate of sufficient size to permit entrance of equipment necessary to allow periodic maintenance activities.

Acceptable backfill and fill materials shall consist of suitable soils for dam construction as determined by the City; free of rock or gravel larger than one inch in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Backfill and fill materials should be placed in layers not more than eight inches in loose depth for material compacted by heavy compaction equipment, and not more than four inches in loose depth for material compacted by hand-operated tampers. Each layer should be uniformly moistened or aerated before compaction to within 3% of optimum moisture content. Layers should not be placed on surfaces that are muddy, frozen, or contain frost or ice. All backfill and fill materials should be placed evenly to required elevations, and uniformly along the full length of the embankment. Additionally, soils should be compacted to at least 95% maximum dry unit weight according to ASTM D 698.

3.2.1. Underground Retention/Detention Ponds

No underground retention/detention pond shall be constructed on residential development projects. Underground retention/detention ponds may be considered on non-residential development projects after the designer has shown that construction of an aboveground retention/detention pond is infeasible to the City's satisfaction. If allowed, all structures, which are designed to store water, shall be constructed of reinforced concrete or HDPE. Additionally, the structures should be designed such that vehicular traffic meeting an H-20 loading standard could traverse the area over the retention/detention pond once backfilled or completed without resulting in the pond's structural failure. When designing the pond, the designer should design the structure such that routine maintenance can be accommodated without unreasonable demands being placed on future property owners.

3.2.2. Stormwater Ponds with Permanent Pools

Stormwater ponds with permanent pools may be constructed if the facilities are designed to the criteria outlined in Section 4.25 of the latest GSMM edition. However, the designer will be required to submit a water balance simulation as part of the Hydrologic and Hydraulic Report Submittal. This requirement does not apply to pools resulting solely from the 1” retention requirement.

3.3. Water Quality Best Management Practices

3.3.1. Best Management Practices

The following general application structural stormwater controls shall be acceptable to meet the water quality requirements for contributing drainage areas. For design, construction and maintenance specifications for each control, the designer is directed to Section 4 of Volume 2 of the 2016 edition of the GSMM.

- Bioretention Areas
- Bioslope
- Downspout Disconnects
- Dry Detention Basins
- Dry Extended Detention Basins
- Dry Wells
- Dry Enhanced Swales/Wet Enhanced Swales
- Grass Channel
- Gravity (Oil-Grit) Separator
- Green Roof
- Infiltration Practices
- Multi-Purpose Detention Areas
- Organic Filter
- Permeable Paver Systems
- Pervious concrete
- Porous Asphalt
- Proprietary systems
- Rainwater Harvesting
- Regenerative Stormwater Conveyance
- Sand Filters
- Site Reforestation/Revegetation
- Soil Restoration
- Stormwater Planters/Tree Boxes
- Stormwater Ponds
- Stormwater Wetlands
- Submerged Gravel Wetlands

- Underground Detention
- Vegetated Filter Strip

As stated earlier, the controls listed herein are designed to meet a portion of the water quality requirements. The accepted water quality treatment rates for TSS for these controls shall be as follows:

- Bioretention Areas – 50%
- Bioslopes Filter Strip – 50%
- Grass Channel – 50%
- Organic Filter – 80%
- Sand Filter – 80%
- Submerged Gravel Wetlands – 80%
- Gravity Separators – 40%
- Stormwater Ponds – 25%

Structural BMPs should be designed so that 80% of the average annual post development total suspended solids load (TSS) is removed before entering the municipal separate stormwater system or channel. The following formula should be used to determine water quality volume (WQ_v):

$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

Where,
WQ_v = Water Quality Volume in acre-feet
P = Rainfall depth in inches, using the Water Quality Storm Event (1.2 inches).
A = Project area in acres.
R_v = Volumetric runoff coefficient [0.05 + 0.009(*I*)], where *I* is the impervious surface percentage (impervious area ÷ total project area) x 100.

3.3.2. <u>Proprietary Structural Controls</u>

The City may at its discretion allow proprietary structural controls. Prior to specification of such a device, the designer shall consult the City to determine if the control will be acceptable.

4. APPROVED HYDROLOGIC & HYDRAULIC METHODS

4.1. Hydrologic Methods

4.1.1. <u>Rational Method</u>

The rational method may be used to develop peak runoff flows for culverts with contributing drainage areas less than 25 acres in size and for detention ponds with contributing drainage areas less than one acre in size. All computations shall be in accordance with Section 3.1.4 of the GSMM (Volume 2). Rainfall intensities shall be derived from Appendix A of the 2016 edition of the

GSMM (Volume 2), which references the National Oceanic and Atmospheric Administration provided rainfall tables for the State of Georgia on its website:
http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ga

As specified above, the rational method may be used to size detention facilities. If the rational method is utilized, the DeKalb Method or the Baumgardner/Morris Method (Terramodel) must be utilized to develop runoff hydrographs. Triangular rational method runoff hydrographs may not be utilized in the design of detention facilities.

4.1.2. NRCS Method

In most cases, the Natural Resources Conservation Service (NRCS) method must be utilized to size detention ponds with contributing drainage areas greater than one acre and culverts with contributing drainage areas greater than 25 acres. All computations shall be in accordance with Section 3.1.5 of the GSMM (Volume 2). Rainfall intensities shall be derived from Appendix A of the 2016 edition of the GSMM (Volume 2), which references the National Oceanic and Atmospheric Administration provided rainfall tables for the State of Georgia on their website:
http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=ga

4.2. Hydraulic Methods -

All hydraulic calculations shall be made in accordance with Chapter 5 of the 2016 edition of the GSMM (Volume 2).

5. SPECIAL DISTRICTS

The City of Albany may establish special design criteria for select areas based on the findings of watershed assessments, hydrologic and hydraulic reports, and known flooding issues. The designer is encouraged to consult with the City to determine if any special districts exist within the City. At the time of this manual's publication, no special districts have been established.

6. STORMWATER CONCEPT PLAN REQUIREMENTS

The City recognizes that some sites will require a substantial investment in time and effort to develop a comprehensive stormwater management plan that will address the requirements contained within this manual. As such, some developments are required to develop a concept plan prior to the land disturbance application submittal. This requirement is aimed at reducing the amount of effort required to develop the final plan and permit the project. When Karst topography considerations are included in the site stormwater management design, a concept plan is encouraged.

Concept plans are required to be submitted for all developments that meet one or more of the following criteria:

- Any residential subdivision with greater than 50 lots, unless such development is comprised of lots which are all 2-acres or greater in area.

- Any non-residential development with a disturbed area of 10 acres or greater.
- Any non-residential development regardless of size which has an impervious surface coverage that covers 50% or more of the property excluding those lands contained within undisturbed buffers including, but not limited to, floodplains, stream buffers and undisturbed buffers between dissimilar zonings.
- Any non-residential development regardless of size, which is defined as a hotspot land use.

As stated earlier, all developments that meet one or more of the requirements listed above are required to submit a stormwater concept plan. However, all developments may submit a plan for a preliminary evaluation. If a stormwater concept plan is submitted to the City, the plan should contain the following sections.

6.1. Project Narrative

A brief narrative must be provided with the report outlining the project goals and a location map such that the project location can be identified by City staff.

6.2. Existing Conditions Hydrologic Analysis

The existing conditions hydrologic analysis should provide the reader with a comprehensive evaluation of the site conditions prior to the project's development. The designer should provide the following information with this element of the report:

6.2.1. Existing Conditions Narrative

A written description of the existing conditions found at the site should be provided. Additionally, the narrative should describe the methodologies, assumptions and other pertinent discussions of how the existing conditions were analyzed by the designer.

6.2.2. Existing Conditions Map

An existing conditions map should be provided with the report including, but not limited to, the following:

- Topography (2-ft. or less contour interval) of existing site conditions. Topographic information must be signed and sealed by a Registered Land Surveyor in the State of Georgia. Enough offsite topographic information must be provided so as to determine the presence of any offsite inflows to the site.
- Perennial/intermittent streams, wetlands, lakes and other surface water features
- Drainage basin delineations showing the location of each drainage sub-basin
- Drainage basin delineations for each contributing drainage basin upstream of the project on an appropriate map (USGS Quadrangle, etc.)
- Existing stormwater conveyances and structural control facilities
- Flow direction and discharge points from the site including sheet flow areas
- Any area of significant depression storage
- Federal, state and local buffers

The map should provide a clear understanding of the various drainage patterns located throughout the site as well as drainage onto the site from upstream areas. Additionally, the map should provide a clear view of the site's natural features that may impact development.

6.2.3. Existing Conditions Tables

A set of tables should be included in the report that will allow the reader to understand how various parameters utilized in modeling the existing conditions were developed. Additionally, tables should be included, documenting the modeling results:

- A table listing the acreage, soil types and land cover characteristics for each sub-basin
- A table listing the total acreage, composite curve number and time of concentration for each sub-basin
- A table listing the peak runoff rates and total runoff volumes from each sub-basin
- A table listing the peak runoff rates and total runoff volumes for each drainage area upstream of the project site
- A table listing the peak runoff rates and maximum water surface elevations for all detention facilities studied as part of the existing conditions analysis

6.2.4. Existing Conditions Model Diagram

A diagram of the hydrologic model should be provided with the report showing how the model was developed and each node is connected.

6.3. Preliminary Downstream Analysis

The downstream analysis should provide the reader with a comprehensive picture of the downstream areas and their capacity to accommodate stormwater runoff from the proposed development.

6.3.1. Maps

- Drainage basin delineations showing the point at which the contributing area of the project represents 10% of the total drainage basin area as defined in Section 3.1.9.2 of the 2016 edition of Volume 2 the GSMM. With the City's underlying Karst topography, there are localized low areas with no surface flow outlet; the designer must include analysis of these areas where applicable.
- Identify culverts, channels and other structural stormwater controls that the stormwater runoff must pass through prior to the 10% point identified previously.

6.3.2. Narratives

Provide a narrative with associated calculations demonstrating the downstream analysis at various points showing existing conditions and future conditions without detention or other onsite stormwater controls.

6.3.3. Downstream Analysis Model Diagram

A diagram of the hydrologic model should be provided with the report showing how the model was developed and each node is connected.

6.4. Preliminary Stormwater Management Plan

A preliminary stormwater management plan should be included with the concept plan submittal. The purpose of a preliminary stormwater management plan will be to show that the proposed controls will be sufficient to meet the requirements outlined in this manual. As such, the following should be provided with the concept plan.

6.4.1. Narratives

A written description of the proposed site conditions should be provided. Additionally, the narrative should describe the means by which stormwater runoff will be managed by the designer including proposed stormwater quality BMPs and detention facilities.

6.4.2. Proposed Conditions Maps

A proposed conditions map should be provided with the report including, but not limited to, following:

- A general proposed conditions drainage map. It is not necessary to produce a full grading plan as part of this submittal. The detail should be sufficient to show how the designer proposes to grade the site and drainage will be managed on site. This should be accomplished at a minimum with flow arrows and spot elevations to indicate a feasible grading concept. Proposed elevation contours must meet existing contours.
- Drainage basin delineations for each discharge point from the site
- Drainage basin delineations for each water quality BMP and detention facility indicating the approximate drainage area for each
- Location and type of each water quality BMP
- Location of each detention facility

The map should provide a clear understanding of the various drainage patterns located throughout the site, as well as drainage onto the site from upstream areas. Additionally, the map should provide a clear view of the site’s natural features that will be impacted by development.

7. HYDROLOGIC & HYDRAULIC REPORT REQUIREMENTS

All development projects must submit a hydrologic and hydraulic report outlining the impacts of the site on the stormwater system. At a minimum, this report must include the following sections:

- Certification by Registered Professional
- Project Narrative
- Existing Conditions Hydrologic Analysis
- Post-Development Hydrologic Analysis
- Stormwater Management System Design
- Downstream Analysis
- Operations & Maintenance Plan

The following subsections outline the requirements for each of the elements outlined above.

7.1. Professional Certification

Each report should begin with the following statement and be signed and sealed by the professional who prepared the report and analysis:

> "I, (Name of Professional), a Registered (Professional Engineer / Land Surveyor) in the State of Georgia, hereby certify that the grading and drainage plans for the project known as (Project Name), lying in Land Lot (XXX), of the (XX) District, Dougherty County, Georgia, have been prepared under my supervision, and, state that in my opinion, the construction of said project will not produce storm drainage conditions that will cause damage or adversely affect the surrounding properties for the storm events specified in City of Albany Land Development Regulations. This (day) day of (Month), (Year)."

7.2. Project Narrative

A brief narrative should be provided with the report outlining the project goals, location and provide a location map such that the project location can be identified by City staff.

7.3. Existing Conditions Hydrologic Analysis

The existing conditions hydrologic analysis should provide the reader with a comprehensive evaluation of the site conditions prior to development. The designer should provide the following information with this element of the report:

7.3.1. <u>Existing Conditions Narrative</u>

A written description of the existing conditions found at the site should be provided. Additionally, the narrative should describe the methodologies, assumptions and other pertinent discussions of how the existing conditions were analyzed by the designer.

7.3.2. <u>Existing Conditions Map</u>

An existing conditions map should be provided with the report including, but not limited to, the following:

- Topography (2-ft. or less contour interval) of existing site conditions. Topographic information must be signed and sealed by a Registered Land Surveyor in the State of Georgia. Enough offsite topographic information must be provided so as to determine the presence of any offsite inflows to the site.
- Perennial/intermittent streams, wetlands, lakes and other surface water features
- Drainage basin delineations showing the location of each drainage sub-basin
- Drainage basin delineations for each contributing drainage basin upstream of the project site on an appropriate map (USGS Quadrangle, etc.)
- Existing stormwater conveyances and structural control facilities
- Flow direction and discharge points from the site including sheet flow areas
- Any area of significant depression storage
- Federal, state, and local buffers

The map should provide a clear understanding of the various drainage patterns located throughout the site, as well as drainage onto the site from upstream areas. Additionally, the map should provide a clear view of the site's natural features that may impact development.

7.3.3. Existing Conditions Tables

A set of tables should be included in the report that will allow the reader to understand how various parameters utilized in modeling the existing conditions were developed. Additionally, tables should be included documenting the results of the modeling:

- A table listing the acreage, soil types and land cover characteristics for each sub-basin
- A table listing the total acreage, composite curve number and time of concentration for each sub-basin
- A table listing the peak runoff rates and total runoff volumes from each sub-basin
- A table listing the peak runoff rates and total runoff volumes for each drainage area upstream of the project site
- A table listing the peak runoff rates and maximum water surface elevations for all detention facilities studied as part of the existing conditions analysis

7.3.4. Existing Conditions Model Diagram

A diagram of the hydrologic model should be provided with the report showing how the model was developed and each node is connected. The report should include the hydrographs for all design storms.

7.4. Post-Development Hydrologic Analysis

The proposed conditions hydrologic analysis should provide the reader with a comprehensive evaluation of the site conditions following development of the project. The designer should provide the following information with this element of the report:

7.4.1. Proposed Conditions Narrative

A written description of the proposed site conditions after construction should be provided. Additionally, the narrative should describe the methodologies, assumptions and other pertinent discussions of how the proposed conditions were analyzed by the designer.

7.4.2. Proposed Conditions Map

A proposed conditions map should be provided with the report including, but not limited to, the following:

- Topography (2-ft. or less contour interval) of existing site conditions. Topographic information must be signed and sealed by a Registered Land Surveyor in the State of Georgia. Enough offsite topographic information must be provided so as to determine the presence of any offsite inflows to the site.
- Perennial/intermittent streams, wetlands, lakes and other surface water features
- Drainage basin delineations showing the location of each drainage sub-basin
- Proposed stormwater conveyances and structural control facilities
- Direction of flow and discharge points from the site including sheet flow areas
- Location and boundaries of proposed natural feature protection areas
- All existing and proposed finished floor elevations located in each routed basin

The map should provide a clear understanding of the various drainage patterns located throughout the site, as well as drainage onto the site from upstream areas. Additionally, the map should provide a clear view of the site's natural features that will be impacted by the development, as well as features that will not be impacted.

7.4.3. Proposed Conditions Table

A set of tables should be included in the report that will allow the reader to understand how various parameters utilized in modeling the proposed conditions were developed. Additionally, tables should be included documenting the results of the modeling:

- A table listing the acreage, soil types and land cover characteristics for each sub-basin
- A table listing the total acreage, composite curve number and time of concentration for each sub-basin
- A table listing the peak runoff rates and total runoff volumes from each sub-basin
- A table listing the peak runoff rates and total runoff volumes for each drainage area upstream of the project site
- A table listing the peak runoff rates and maximum water surface elevations for all detention facilities studied as part of the proposed conditions analysis

7.4.4. Proposed Conditions Model Diagram

A diagram of the hydrologic model should be provided with the report showing how the model was developed and each node is connected. The report should include the hydrographs for all design storms and pond sizing calculations.

7.5. Stormwater Management System Design

The stormwater management system design should provide the reader with a comprehensive description of the proposed stormwater management system components. The designer should provide the following information with this element of the report:

7.5.1. Stormwater Management System Map

The stormwater management system map should document the various structural components of how stormwater runoff will be moved around the site.

- Location of all non-structural stormwater controls
- Location of all existing stormwater controls to remain after development
- Location of all proposed stormwater controls
- Location of all proposed impoundment type controls (i.e. detention/retention ponds, stormwater ponds, stormwater wetlands, etc.)
- Location of all conveyance structures
- All impoundment-type controls should be labeled with the following information:
    - Maximum water surface elevation
    - Depth and storage volumes for the design storm
    - Depth and storage volumes maximum water surface if the design storm event is exceeded (i.e. top of dam)
- All inlets to conveyance structures should be labeled with the following information:
    - Maximum design water surface
    - Maximum potential water surface

- All inlets and manholes should be labeled with the following information:
  - Structure number (if applicable)
  - Rim elevation
  - Invert, size and direction of all connected pipes
- All pipes should be labeled with:
  - Length
  - Material
  - Slope
- All pipes should be profiled and labeled with:
  - Length
  - Material
  - Slope
  - Hydraulic grade line
- Map showing all contributing drainage areas/sub-basin delineations

7.5.2. <u>Narratives</u>

- Narrative describing that appropriate and effective structural stormwater controls have been selected
- Design calculations and elevations for all existing and proposed stormwater conveyance elements including stormwater drains, pipes culverts catch basins, channels, swales and areas of overland flow
- Design calculations and elevations for all structural water quality BMPs to be utilized for water quality improvement
- Design calculations showing that the design meets the requirements of the water quality improvements as outlined in the ordinance and local design manual. The City encourages the designer to utilize the site design tool provided by the North Georgia Water Planning District to meet this requirement. The tool can be acquired from the following website: http://www.northgeorgiawater.com/

7.6. Downstream Analysis

The downstream analysis should provide the reader with a comprehensive picture of the downstream areas and their capacity to accommodate stormwater runoff from the proposed development. With the City's underlying Karst topography, there are localized low areas with no surface flow outlet; the designer must include analysis of these areas where applicable.

7.6.1. <u>Maps</u>

- Drainage basin delineations showing the point at which the contributing area of the project represents 10% of the total drainage basin area as defined in Section 3.1.9.2 of the 2016 edition of Volume 2 the GSMM.
- Identify culverts, channels and other structural stormwater controls that the stormwater runoff must pass through prior to the 10% point identified previously.

7.6.2. <u>Narratives</u>

Provide a narrative with associated calculations demonstrating the downstream analysis at various points showing existing conditions, future conditions without detention or other onsite stormwater controls and future conditions with detention or other onsite stormwater controls.

7.7. Operations & Maintenance Plan

A narrative of what maintenance tasks will be required for the stormwater controls specified for the site as well as the responsible parties. Additionally, the report will need to identify access and safety issues for the site. Maintenance issues for various BMPs and other stormwater controls can be found in the GSMM.

8. REQUIREMENTS FOR WAIVER REQUEST

The City does not intend to waiver from the requirements outlined in this manual. However, the City recognizes that situations exist such that strict adherence to the requirements may result in degradation of upstream or downstream areas from a development project. As such, the City may from time to time allow a variance from the procedures and requirements outlined in this manual. The following documents the minimum criteria that will apply to all variance requests.

8.1. Waiver Narrative

A brief narrative should be provided with each waiver request describing the project, location, and provide a location map such that the project location can be identified by City staff. Additionally, a narrative should be provided outlining the standards for which the applicant is seeking a waiver, as well as a description of the impacts that will result from granting the waiver.

8.2. Existing Conditions Hydrologic Analysis

The existing conditions hydrologic analysis should provide the reader with a comprehensive evaluation of the site conditions prior to development. The designer should provide the following information with this element of the waiver request:

8.2.1. <u>Existing Conditions Narrative</u>

A written description of the existing conditions found at the site should be provided. Additionally, the narrative should describe the methodologies, assumptions and other pertinent discussions of how the existing conditions were analyzed by the designer.

8.2.2. <u>Existing Conditions Map</u>

An existing conditions map should be provided with the report including, but not limited to, the following:

- Topography (2-ft. or less contour interval) of existing site conditions. Topographic information must be signed and sealed by a Registered Land Surveyor in the State of Georgia. Enough offsite topographic information must be provided so as to determine the presence of any offsite inflows to the site.
- Perennial/intermittent streams, wetlands, lakes and other surface water features
- Drainage basin delineations showing the location of each drainage sub-basin

- Drainage basin delineations for each contributing drainage basin upstream of the project on an appropriate map (USGS Quadrangle, etc.)
- Existing stormwater conveyances and structural control facilities
- Flow direction and discharge points from the site including sheet flow areas
- Any area of significant depression storage
- Federal, state and local buffers

The map should provide a clear understanding of the various drainage patterns located throughout the site, as well as drainage onto the site from upstream areas. Additionally, the map should provide a clear view of the natural features of the site that may impact development.

8.2.3. Existing Conditions Tables

A set of tables should be included in the report that will allow the reader to understand how various parameters utilized in modeling the existing conditions were developed. Additionally, tables should be included documenting the results of the modeling:

- A table listing the acreage, soil types and land cover characteristics for each sub-basin
- A table listing the total acreage, composite curve number and time of concentration for each sub-basin
- A table listing the peak runoff rates and total runoff volumes from each sub-basin
- A table listing the peak runoff rates and total runoff volumes for each drainage area upstream of the project site
- A table listing the peak runoff rates and maximum water surface elevations for all detention facilities studied as part of the existing conditions analysis

8.2.4. Existing Conditions Model Diagram

A diagram of the hydrologic model should be provided with the report showing how the model was developed and each node is connected.

8.3. Downstream Analysis

The downstream analysis should provide the reader with a comprehensive picture of the downstream areas and their capacity to accommodate stormwater runoff from the proposed development.

8.3.1. Maps

- Drainage basin delineations showing the point at which the contributing area of the project represents 10% of the total drainage basin area as defined in Section 3.1.9.2 of the 2016 edition of Volume 2 the GSMM.
- Identify culverts, channels and other structural stormwater controls that the stormwater runoff must pass through prior to the 10% point identified previously.

8.3.2. Narratives

Provide a narrative with associated calculations demonstrating the downstream analysis at various points showing existing conditions, future conditions without detention or other onsite stormwater controls, future conditions with appropriate detention or other onsite stormwater controls, and future conditions with controls that would be put in place if the waiver were granted.

8.3.3. Downstream Analysis Model Diagram

A diagram of the hydrologic model should be provided with the report showing how the model was developed and each node is connected.

8.4. Post-Development Hydrologic Analysis

The proposed conditions hydrologic analysis should provide the reader with a comprehensive evaluation of the site conditions following development. The designer should provide the following information with this element of the report:

8.4.1. Proposed Conditions Narrative

A written description of the proposed conditions assuming the waiver is granted should be provided. Additionally, the narrative should describe the methodologies, assumptions and other pertinent discussions of how the proposed conditions were analyzed by the designer.

8.4.2. Proposed Conditions Map

A proposed conditions map should be provided with the report including, but not limited to, the following:

- Topography (2-ft or less contour interval) of proposed site conditions. Topographic information must be signed and sealed by a Registered Land Surveyor in the State of Georgia. Enough offsite topographic information must be provided so as to determine the presence of any offsite inflows to the site.
- Perennial/intermittent streams, wetlands, lakes and other surface water features
- Drainage basin delineations showing the location of each drainage sub-basin
- Proposed stormwater conveyances and structural control facilities
- Flow direction and discharge points from the site including sheet flow areas
- Location and boundaries of proposed natural feature protection areas

The map should provide a clear understanding of the various drainage patterns located throughout the site, as well as drainage onto the site from upstream areas. Additionally, the map should provide a clear view of the site's natural features that will be impacted by development, as well as features that will not be impacted.

8.4.3. Proposed Conditions Tables

A set of tables should be included in the report that will allow the reader to understand how various parameters utilized in modeling the proposed conditions were developed. Additionally, tables should be included documenting the results of the modeling:

- A table listing the acreage, soil types and land cover characteristics for each sub-basin
- A table listing the total acreage, composite curve number and time of concentration for each sub-basin
- A table listing the peak runoff rates and total runoff volumes from each sub-basin
- A table listing the peak runoff rates and total runoff volumes for each drainage area upstream of the project site
- A table listing the peak runoff rates and maximum water surface elevations for all detention facilities studied as part of the proposed conditions analysis

8.4.4. Proposed Conditions Model Diagram

A diagram of the hydrologic model should be provided with the report showing how the model was developed and each node is connected.

9. POST CONSTRUCTION

9.1. As-Built Information

Pursuant to City Ordinance 54-57 (b) and (c): Upon completion of the construction phase on the project, and prior to approval of the final plat or issuance of a certificate of occupancy, the developer shall provide an as-built survey and an as-built design certification for each stormwater management facility. A certified record drawing of the facility shall be prepared based upon this as-built survey and certified by the design professional who prepared the stormwater management plan.

An as-built survey of the control structure(s) or water quality structure(s) must be submitted to the Engineering Department when it/they become available.

9.2. Electronic Drawings

Pursuant to City Ordinance 54-6, the City of Albany is responsible for determining the stormwater user fees based on the development's impervious area. Prior to the issuance of a certificate of occupancy, an electronic drawing (submitted as a .dwf file) shall be submitted to the Engineering Department with the impervious areas indicated.

10. <u>APPENDIX A: KARST AREAS</u>

10.1. Sources

Portions of this document borrow heavily from published federal and state resources on designing stormwater features in karst terrain. In particular, the Tennessee Stormwater Design Guidelines for Karst Terrain and the Virginia Stormwater Management Handbook, are referenced extensively. A full list of references is included at the end of this section.

10.2. Feasibility

The intent of this appendix is to detail steps that should be taken when designing stormwater controls to meet runoff reduction requirements or Green Infrastructure/Low Impact Development (GI/LID) components in karst terrain. The document gives an overview of the extent of karst terrain in the Albany area, and a rationale for why karst landforms may be incompatible with infiltration components or GI/LID components. A flowchart is then included to detail the steps that should be taken to assess the feasibility of including these controls on property with karst landforms. It is the developer's responsibility to assess each of these feasibility steps and confer with Albany staff to determine if any problems on the site can be mitigated through alternative engineering design. If runoff reduction, and GI/LID controls are not feasible for a site, then water quality performance measures will still apply, and alternative controls may be warranted, including series application of measures to meet the water quality criteria.

10.3. Definition

Karst areas are defined by carbonate soil formations that can be present in surficial outcrops or can range several hundred feet deep. The carbonate formations can contain limestone, dolomite, or a combination of soluble rocks. The carbonate formations are soluble in varying degrees in groundwater and rainwater, and can form large and small depressions in the ground when the limestone degrades to the point that it can no longer support itself and the overlying soil burden. The karst geography around Albany, GA has been studied in detail and the results published in a variety of reports. In 1962, Robert Wait of the United States Geologic Survey (USGS), published the *Geology of the Albany West Quadrangle*, detailing the cross-section of the soil bulk matrix profile and the depth to the Ocala limestone that underlays the entire area. According to Wait, the Ocala limestone is relatively uniform almost entirely calcium carbonate. The limestone is exposed by the Flint River throughout the area, and includes benches and shelves that appear at outcrops along the river bank. The entire area is karst and contains many sinkholes. Figure 1 shows an aerial photograph from the United States Department of Agriculture (USDA) from 1948 that was taken after substantial rainfall and shows the spatial extent of the sinkholes throughout the area (Georgia Aerial Photographs Database). According to Wait's Geology and Ground-Water Resources of Dougherty County, Georgia (1963):

> The area is generally considered to have two varieties of sinkholes: older and younger sinkholes, with the older being domes that collapsed after dissolution and which are typically 20-25' deep and 500'-1000' wide. The younger sinkholes are considered to occur from occlusions of limestone or pillars present in the underlying strata which then collapse and open up holes and drains that connect the underlying karst system. Review of the Ocala formation indicates that the fracture lines appear to run northwest to southeast, although as a general trend the actual orientation of the sinkholes in and around Albany varies.

The residents of Georgia's lower coastal plain utilize groundwater almost exclusively for their water supply, and Albany is no different. Albany withdraws several million gallons per day (MGD) from the Upper Floridan aquifer, which is the name given to the water bearing strata that covers most of coastal Georgia and Florida and includes the Ocala limestone formation. The Upper Floridan is highly productive and has very good water quality. Because it is a limestone aquifer, excessive pumping of individual wells or wellfields can exacerbate sinkholes in the surrounding area (Gordon, 2011), which can risk introduction of foreign materials into the water source. Any development activities near water production facilities should be thoroughly coordinated with Albany staff prior to submitting a development plan.

Figure 1 shows the aerial photograph from the USDA flyover in 1948, while Figure 2 shows the Western Quadrangle analyzed by Wait in 1962. Figure 3 shows the different geologic layers, including the Ocala limestone formation and its relevant location to the Flint River (Wait, 1962). Figure 4 shows the limestone outcrop along the Flint River underneath the Broad Avenue / King Bridge.

(continued)

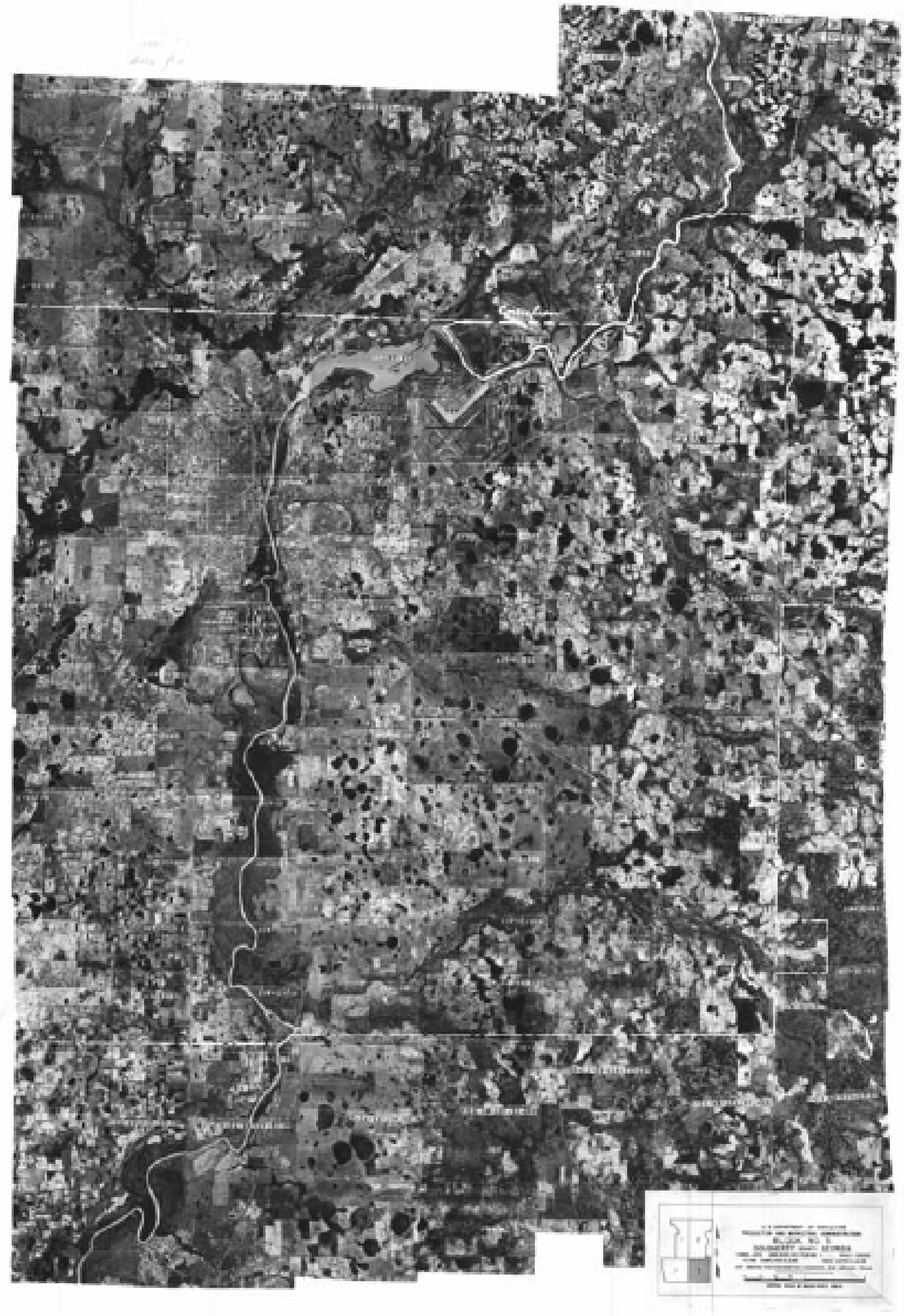


Figure 1: Aerial Photo from 1948 showing the extensive number of sinkholes in the Albany area (USDA, 1948).

Figure 2: Albany west quadrangle showing geology of the karst landscape (Wait, 1962).

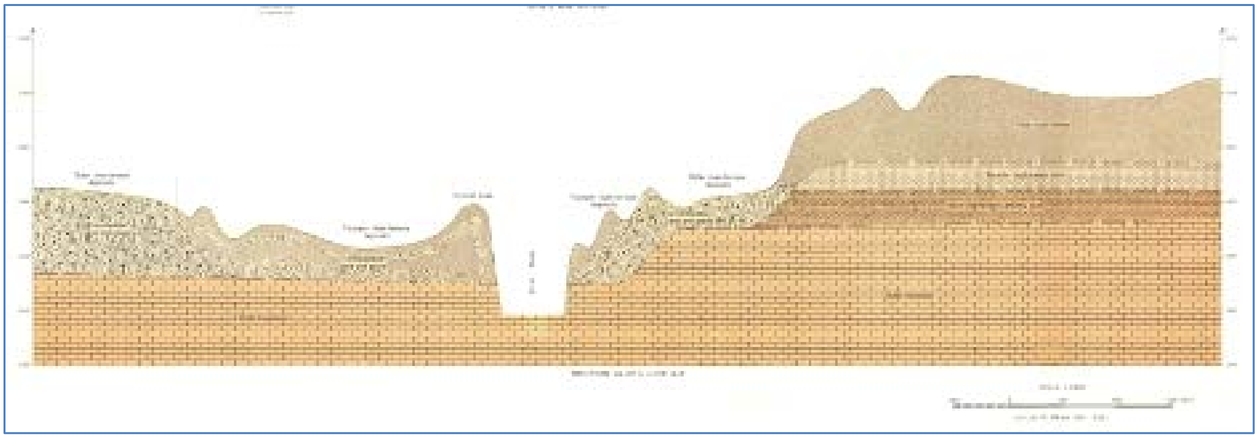


Figure 3: Cross-section A-A showing the Ocala limestone and the Flint River (Wait, 1962).

Figure 4: Limestone outcrop along the Flint River in downtown Albany.

10.4. Stormwater Management Issues in Karst Areas

The principal concerns with stormwater infiltration that is encouraged by Green Infrastructure/ Low Impact Development (GI/LID) in Albany's karst regions are sinkhole prevention and the minimization of potential aquifer and surface water contamination, including the Floridan aquifer and the Flint River.

10.4.1. <u>Groundwater and Surface Water Contamination Risks</u>

In karst terrain, contaminants in runoff and can pass rapidly from the surface into groundwater, with little or no filtration or modification. In other cases, contaminants can be perched by restrictive layers present in and around the downtown area, and can release pollutants into the groundwater more gradually.

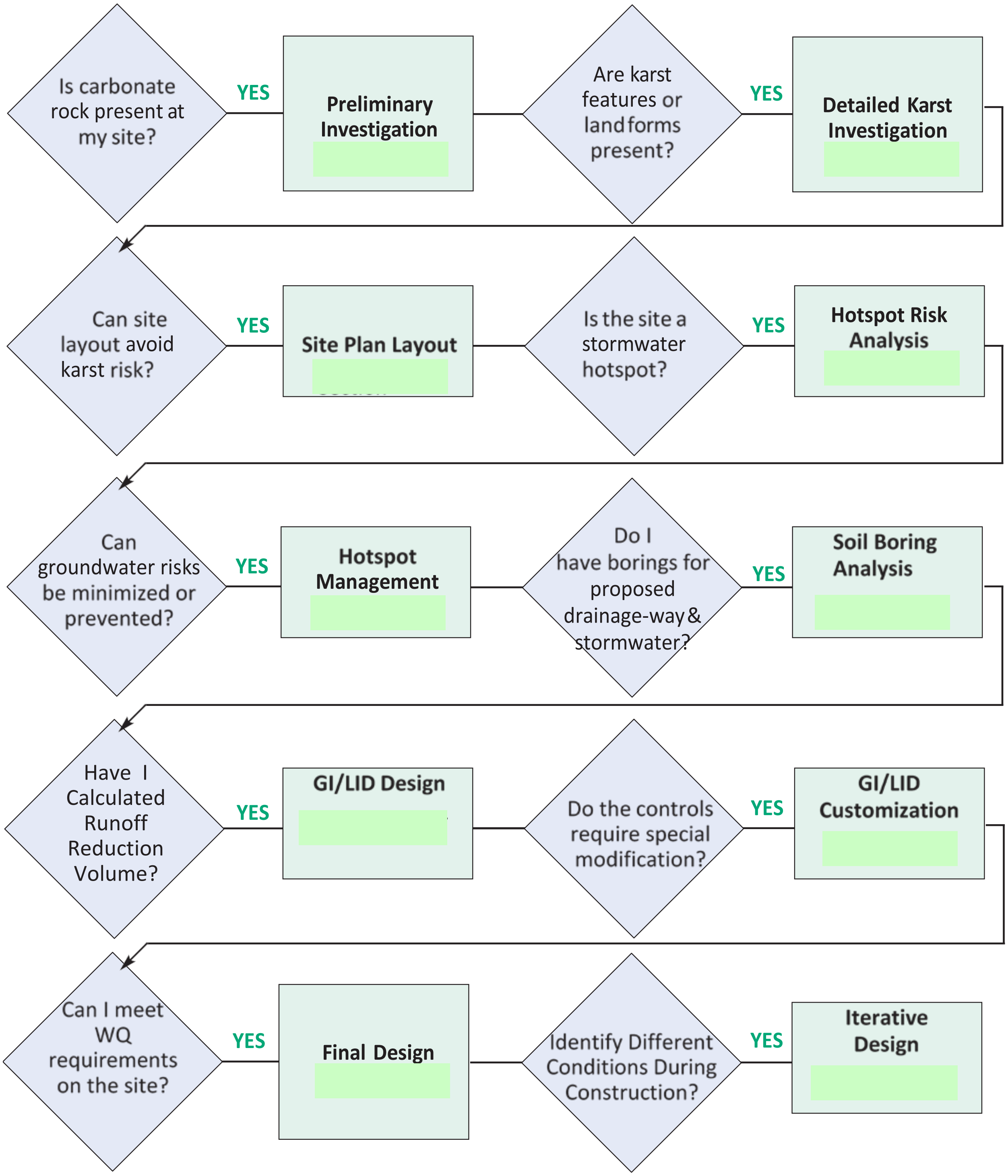
The strong interaction between surface runoff and groundwater can pose risks to the drinking water quality, upon which residents in karst terrain rely. Albany's principal wellfields are south of the City in the upper Floridan. Depending on the quantity and type of pollutants that can be discharged directly to groundwater sources, it is possible to render the water unsuitable for consumption by humans and farm animals. In addition, as the Flint River cuts through the upper layers of the overlying limestone, there exists ample opportunity for direct interaction and discharge of the unfiltered flows to the river. As a result, designers need to consider groundwater and surface water protection as a first priority when they are considering how to dispose of stormwater. The extensive combinatorial interaction of the complex karst system in Albany indicates that there is always a risk that contaminants will end up in places where they were not intended, and can be difficult to remove.

10.4.2. <u>Increased Sinkhole Formation</u>

Several items can compound the increased risk of sinkhole formation. First, the increased runoff from developed property can increase the dissolution rate of underlying carbonate materials. Also, the decreased infiltration rate under impervious areas can adversely impact the soil-water matrix, removing buoyancy provided by the water and resulting in increased likelihood of subsidence. Finally, concentration of water in larger centralized stormwater practices can place additional pressure on existing sinks and accelerate failure. Consequently, designers need to carefully assess the entire stormwater conveyance and treatment system at the site to minimize the risk of sinkhole formation. In most cases, this means installing a series of small, shallow runoff reduction practices across the site, rather than using the traditional all-in-one pond approach.

The flow chart below was synthesized from several sources, and borrows directly from the VA DCR (1999) Appendix on development in karst terrain (VA Stormwater Management Handbook, 2013). As in those documents, it is important to note that the flow chart is a guideline for evaluating and minimizing risk for developing stormwater infiltration practices on karst terrain, and not a guideline for plan approval in Albany. If karst conditions exist on a site, then each of these steps should be evaluated to determine the feasibility of installing traditional GI/LID controls on the site.

10.5. Flow Chart



10.5.1. Preliminary Investigation

Preliminary site investigations are targeted toward gathering historical knowledge about a site from a variety of sources. These sources can include, but should not be limited to:

1. Existing soil surveys
2. Existing geologic maps,
3. Existing physiographic maps,
4. Existing elevation information, including USGS DEMs and current LiDAR or contour information,
5. Existing well borehole information in the area,
6. Previous development plans,
7. Any existing hydrologic maps,
8. Aerial photographs of the site and surrounding area.

At the conclusion of the preliminary investigation, the designer should have all available resources necessary to describe the site conditions to the degree possible to conduct a detailed investigation. From the preliminary information, any site limitations should be identified and shown on the plans, as well as any special conditions which may enhance the treatment, or reuse of the stormwater in addition to the infiltration components.

10.5.2. Detailed Karst Investigation

A more detailed investigation will require an in-person review of the site conditions, in particular looking for karst features. Those may include sinkholes, caverns, openings, subsidence of the ground, or hydrologic features that disappear or have no apparent outlet. In addition, the developer should talk to any existing or historical property owners who are available to determine if any active karst formations have been present or recorded on the site. Any of these features should be recorded and evaluated in a complete data analysis of the site in order to determine if they would indicate an increased risk at the site. Shallow penetration testing with hand-augers may be sufficient if there is no history or indication of karst formations in the area. If karst formations are found, then more extensive analysis should be performed, including test pit excavation and soil borings along with a complete report of material encountered at each depth. In addition, geophysical methods may be required, including electric resistive tomography, or seismic analysis. These geophysical analyses are more suitable for infill data between known boring or test-pit locations, and should be conducted and interpreted by a qualified professional. All of the data discovered during the detailed investigation should be documented on the site plan layout, or a note included detailing tests which were completed and which indicated suitable conditions.

10.5.3. Site Plan Layout

The site plan layout should contain all pertinent information for managing stormwater, that was collected in the preliminary and detailed site investigations. In particular, the plan should include all elements, including any karst features, all structures, proposed stormwater management controls, and water features present, including depth to the seasonal high-water table. In addition, all relevant calculations should be shown and any GI/LID structures that required alternative design components to make them function on the site.

10.5.4. Hotspot: Risk Analysis

Per the Georgia Stormwater Management Manual, Volume 2 (GSMM, 2016), a hotspot is defined as a land use or activity on a site that produces higher concentrations of trace metals, hydrocarbons or other priority pollutants than are normally found in urban stormwater runoff. Examples of hotspots include:

1. Gas Stations,
2. Vehicle Service and Maintenance Areas,
3. Salvage Yards,
4. Material Storage Sites,
5. Garbage Transfer Facilities,
6. Commercial Parking Lots with high-intensity use,
7. Commercial Car Washes,
8. Home Improvement Stores,
9. Nurseries,
10. Kennels, and
11. Veterinarians' offices.

If karst features are present on the site, and it is proposed to have a landuse that's considered a hotspot, then hotspot management strategies should be employed to minimize contamination risks.

It should be noted that the State of Georgia prohibits permanent storm water infiltration basins in areas having high pollution susceptibility, where pollution susceptibility means the relative vulnerability of an aquifer to being polluted from spills, discharges, leaks, impoundments, applications of chemicals, injections and other human activities in the recharge area (Ga Municipal Code, current). Therefore, hotspot landuses may require additional stormwater control components such as underdrains for infiltration recovery while minimizing contamination risk.

10.5.5. Hotspot Management

In the event that the site will contain a hotspot landuse, and contains karst formations, then special management conditions may be required. In particular, infiltration may be limited by structural controls, or bio-engineered GI/LID components with recovery components to allow shallow ground infiltration and biological treatment while minimizing deep infiltration and pollution risk. In addition, water quality criteria should be met to the maximum extent practicable. The water quality criteria should be to remove 80% of the average annual TSS for the runoff generated from the first 1.2" of rainfall on the site. It may be appropriate to place several controls in series around the site to achieve this level of performance.

10.5.6. Soil Boring Analysis

If karst conditions are found or suspected on the site, then sufficient soil borings should be conducted to characterize the nature of the karst system. Specifically, a full description and boring log should be recorded through the entire depth of the test hole. Additionally, any voids, water lenses, or low-penetration value soils should be clearly identified during the analysis. Any of these conditions should facilitate additional exploration to determine if they are isolated or part of a larger system of underground features that may impact site design.

Alternative assessments on the site may include borehole electrical resistivity analyses from existing wells, soil exploration pits, seismic refraction, or ground penetrating radar. All of these subsurface alternatives should be evaluated by a certified geotechnical engineer having experience in karst terrain in order to provide an opinion for suitability in a GI/LID system.

All pertinent subsurface monitoring results should be noted on the plans, including the locations of borings or exploratory work.

10.5.7. GI/LID Design

At this stage in the design, the plans should indicate whether the runoff reduction requirements can be met on the existing site and which GI/LID components can be utilized to maximize infiltration, reuse, and evapotranspiration. On the design plans, indicate whether the components are from the GSMM, the Albany Local Design Manual (LDM), or from an approved alternative source. Ensure that all calculations are published on the plans in compliance with each source.

10.5.8. GI/LID Customization

If traditional GI/LID structures can't be used in treatment on the site, detail how they are modified to fit into the space provided and still provide a function necessary for runoff reduction and water quality improvement. If the BMP is modified, provide the detailed design calculations for how it meets the performance requirements. If an alternative measure is required by modifying the BMP, has the system been constructed so that several components are functioning in series to provide redundancy or the prescribed level of treatment? In the event that infiltration capacities are limited, additional reuse options such as storage for irrigation may be evaluated, given that the storage volume be balanced with evapotranspiration needs on the site.

10.5.9. Final Design

Final design should include an evaluation of all included design components and should include a comprehensive solution to the problem of infiltrating stormwater in karst geology, along with meeting water quality requirements. The final design should clearly document the rationale for selection of the appropriate controls, in addition to why modifications are made to accommodate site conditions, if required. Any additional components required to meet the necessary treatment volumes should be provided in the construction plans and details.

10.5.10. Iterative Design

If karst element is discovered during construction, immediately bring the element to the attention of the review agencies as this may materially change the function of the project controls. Construction should stop while the responsible personnel determine whether the original intent of the design plan can be met given the system's constraints, or whether an overhaul or upgrade to the plan will be required. In addition, if any design component cannot be constructed as designed, it is the owner's responsibility to notify Albany staff in writing that the plan will require modification, and Albany staff shall reply in writing as to whether the proposed modifications are appropriate for the project scope. Any field modifications approved by Albany shall be recorded on red-line drawings submitted to the City, and marked as received in writing, prior to issuance of a Certificate of Occupancy.

10.6. References

1. Georgia Aerial Photographs Database, Dougherty County. 1948. United States Department of Agriculture Agricultural Stabilization and Conservation Service. http://dbs.galib.uga.edu/gaph/html/dougherty/1948/dougherty_1948_ascs_akw_sid.html
2. Hicks, DW, Krause, RE, Clarke, JS. 1981. Geohydrology of the Albany Area, Georgia. Department of Natural Resources, Environmental Protection Division, Georgia Geologic Survey. Information Circular 57.
3. Georgia Rules and Regulations. Department 391, Chapter 3, Subject 16, Section 2: Criteria for Protection of Groundwater Recharge Areas. http://rules.sos.ga.gov/gac/391-3-16?urlRedirected=yes&data=admin&lookingfor=391-3-16
4. Georgia Stormwater Management Manual, Volume 2. 2016. Technical Handbook. https://atlantaregional.org/natural-resources/water/georgia-stormwater-management-manual/
5. Gordon, Debbie Warner. Hydrologic Factors Affecting Sinkhole Development in a Well Field in the Karst Dougherty Plain, Southwest of Albany, GA. Proceedings of the 2011 Georgia Water Resources Conference.
6. Tennessee Permanent Stormwater Management and Design Guidance Manual, *Appendix B: Stormwater Design Guidelines for Karst Terrain.* https://tnpermanentstormwater.org/manual/27%20Appendix%20B%20Stormwater%20Design%20Guidelines%20for%20Karst%20Terrain.pdf
7. Virginia Stormwater Management Handbook, Chapter 6. July 2013. *Appendix 6-B: Stormwater Design Guidelines for Karst Terrain in Virginia.* https://www.swbmp.vwrrc.vt.edu/wp-content/uploads/24_Chap-6_App-6-B_Stormwater-Design-Guides-for-Karst-Terrain.pdf
8. Wait, Robert L. Geology of the Albany West Quadrangle, Georgia. 1962, United States Geologic Survey, Miscellaneous Geologic Investigations, Map I-348.
9. Wait, Robert L. Geology and Ground-Water Resources of Dougherty County Georgia. 1963. Geological Survey Water-Supply Paper 1539-P.

11. APPENDIX B: Storm Drainage/Hydrology Report Checklist

(The Storm Drainage/Hydrology Report Checklist form
is attached on the following pages.)

City of Albany – Storm Drainage / Hydrology Report Checklist (Issued 12/15/2025)

(based upon requirements of the City of Albany Local Design Manual of Dec. 2025)

Project Name: ______________________________________

Date: _______________________ **By:** ____________________

City of Albany, Georgia - Engineering Department - 240 Pine Avenue, Suite 200 - Albany, GA

HYDROLOGIC & HYDRAULIC REPORT - must include:

Professional Certification (7.1)

Project Narrative & Location Map (7.2)

Existing Conditions Hydrologic Analysis (7.3) - evaluate pre-development site conditions

- Narrative
- Map: 2-ft contours, surface water features, drainage basins & sub-basins, ex. stormwater conveyances and structural control facilities, depiction of drainage patterns located throughout & upstream of the site
- Tables: acreage, soil, land cover, curve numbers, time-of-concentration, peak runoff rates, total runoff volumes, maximum water surface elevations
- Diagram of the hydrologic model

Post-Development Hydrologic Analysis (7.4) - evaluate post-development site conditions

- Narrative
- Map: 2-ft contours, surface water features, drainage basins & sub-basins, ex. stormwater conveyances and structural control facilities, depiction of drainage patterns located throughout & upstream of the site
- Tables: acreage, soil, land cover, curve numbers, time-of-concentration, peak runoff rates, total runoff volumes, maximum water surface elevations
- Diagram of the hydrologic model

Stormwater Management System Design (7.5)

- Comprehensive description and narrative
- Stormwater Management System Map/Construction Plans: stormwater controls, impoundments, conveyance structures; label impoundment controls with maximum water surface elevation, depth and storage volumes; label inlets to conveyance structures with maximum design water surface, maximum potential water surface;
- Pipes labeled with length, material, slope, HGL
- Narrative & design calculations for stormwater drains, pipes culverts catch basins, channels, swales, gutter flow and areas of overland flow.
- Water Quality Treatment – calculations, WQ Volume Required, WQ Volume Provided

Downstream Analysis (7.6) - analyze downstream areas and their capacity to accommodate stormwater runoff from the proposed development; note where downstream receiving areas are localized low areas without surface outfalls.

- Drainage basin map delineating the point at which the contributing area of the project represents 10% of the total drainage basin area
- Identify and analyze culverts, channels and other structural stormwater controls that the stormwater runoff must pass through prior to the 10% point
- Narrative & calculations of downstream analysis at various key points showing existing and future conditions impact.

Operations & Maintenance Plan (7.7) - List specific tasks that will be required, stormwater controls & responsible parties; identify access and safety issues for the site.

GENERAL LEVEL OF SERVICE STANDARDS – calculations review

Retention & Detention Requirements (2.1):

- Discharge Rates from New Development Projects and Redevelopment Projects - no increases in (peak) stormwater runoff rates shall be allowed at any discharge point from the site unless approved by the City. The project must be analyzed comparing pre-development and post development discharge for the following storm events:
    - Initial 1-inch runoff reduction volume retained on site
    - 2-yr/24-hr
    - 5-yr/24-hr
    - 10-yr/24-hr
    - 25-yr/24-hr
    - 50-yr/24-hr
    - 100-yr/24-hr
- Where retention is required or selected for stormwater management, retention ponds shall be designed to manage the 100 year storm event runoff from the drainage basin (i.e.: where the receiving drainage basin does not have a gravity-flow outlet; to be determined at the pre-development consultation where applicable). The runoff coefficient for the pond area itself should be considered as 0.95.

Conveyance Systems (2.2):

- Bridges 100-yr/24-hour storm & 100-year flood elevation 1-foot below the low cord of the bridge
- Longitudinal Culverts & Pipe Systems convey the 10-year storm event. HGL 6" below inlet or rim elevation of the inlet or manhole/junction box.
- Roadside Ditches convey the 10-year storm event.
- Ditches with contributing drainage areas greater than 25 acres convey the 25-yr/24-hr storm.
- Cross Drain Culverts with contributing drainage areas greater than 25 acres convey the 25-yr/24-hr storm.
- Drainage Channels designed from or to a culvert shall be sized to accommodate the same storm event specified for the pipe system at a minimum.
- Drainage Channels designed to convey stormwater runoff to detention ponds shall be sized to accommodate the 100-year design storm.
- The minimum velocity for pipes is three feet per second during the 2-year design storm to promote sediment removal *(this may not be possible with small drainage areas and minimum pipe sizes)*
- Inlets (catch basins, yard inlets, drop inlets, hooded grate inlets, flumes) that collect stormwater runoff from street surfaces and area inlets, 10-yr storm event.
- Inlets and grading adjacent to habitable structures shall be designed to prevent stormwater runoff from entering the structure during the 100-yr design storm.
- Maximum spacing of inlets located on public streets is 400 feet.
- Headwalls, Flared End Sections, and Similar Pipe End Treatments sized to capture the storm event specified for the downstream pipe system. The HGL 6" minimum below the edge of pavement, or the point at which water would bypass the inlet (i.e. bypass to another inlet, etc.) whichever is less. Headwater from an inlet should not back water into another culvert or drainage system *(this can be waived by the City in situations where infeasible)*

Design Gutter Spread for the 10-yr storm event and the following:

Roadway Classification/Use		Flooding Spread/Depth
• Emergency Access Routes	-	8.0 ft maximum gutter spread
• Collector Roads	-	8.0 ft maximum gutter spread
• Local Roads	-	8.0 ft center lane width maintained
• Roads with No Other Outlet	-	8.0 ft center lane width maintained
• Parking Lots	-	0.5 ft maximum depth
• Parking Lots (100-year storm)	-	1.0 ft maximum flooding depth

- Detention Areas utilized for other purposes with general public access (i.e. parking lot detention, etc.) with flood warning sign - 1.5 ft max. depth
- Material Storage Areas/Landscape Areas with flood warning sign if area is utilized by the public (with a check of the 100-year storm flooding depth) - 2.0 ft max. depth

Stormwater Quality Treatment (2.3):

- Stormwater Quality in New Development – The stormwater management system shall be designed to retain the 1.0-inch runoff reduction volume, to the maximum extent practicable.
  - The following areas are exempt from water quality treatment:
    - Portions of the site that lie within City mandated undisturbed buffers.
    - Portions of the site that lie within 50 feet of the property line and drain away from the site with no impervious surfaces
    - Impervious surfaces associated with the driveway for the first 50 feet from the public street edge of pavement
    - Portions of the site of at least 10,000 square feet of contiguous area which will remain undisturbed and which does not drain to a water quality or detention facility/BMP. (protected from such construction activities)
- Stormwater Quality in Redevelopment - The stormwater management system shall be designed to retain the 1.0-inch runoff reduction volume, to the maximum extent practicable.
  - The following areas are exempt from water quality treatment:
    - Portions of the site that lie within 50 feet of the property line and drain away from the site with no impervious surfaces
    - Impervious surfaces associated with the driveway for the first 50 feet from the public street edge of pavement

[Landfills, Construction Sites, and Industrial Sites (NPDES Industrial Stormwater Permitted Sites Only) are hotspots that require NPDES Permits and are considered compliant with the water quality requirements of this section under their EPD NPDES permit.]

- Stormwater Quality Requirements for Hotspot Land Uses for New and Re-Development - the following land uses/activities are hotspots and require the listed treatments:
  - *Gas/fueling stations* - oil/water separators
  - *Large parking lots* - oil/water separators
  - *Vehicle maintenance areas* - oil/water separators
  - *Vehicle washing/steam cleaning areas* - oil/water/grit separators (sand filters may be utilized in lieu w/ City approval)
  - *Auto recycling facilities* - oil/water separators

- *Outdoor material storage areas* are required to construct and maintain sedimentation basins meeting the minimum standards outlined in the Georgia Manual for Sedimentation and Erosion (current edition) to collect and treat stormwater runoff from those areas where materials will be stored.
- *Loading and transfer areas* (truck docks are exempt) - evaluated on a case by case basis; if primary concern is solids transport to nearby streams and drainage structures, then required to construct and maintain sedimentation basins; if primary concern is hydrocarbons and other floatable contaminants, then required to construct and maintain oil/water separators
  - All oil/water separators should be designed to the following criteria:
    - Sized to treat the Water Quality Volume.
    - Designed as an off-line system.
    - Designed to pre-treat stormwater runoff before entering other Water Quality BMPs.
- Energy Dissipation - Energy dissipation verification/design for new stormwater facility

APPROVED HYDROLOGIC & HYDRAULIC METHODS (4) – Modeling Review

Hydrologic Methods (4.1)

- Rational Method - for culverts with contributing drainage areas less than 25 acres in size and for detention ponds with contributing drainage areas less than one acre in size. [*for detention use DeKalb Method or the Baumgardner/Morris Method (Terramodel)*]
- SCS Method - for detention ponds w/contributing drainage areas greater than 1 ac; AND for culverts with contributing drainage areas greater than 25 ac. Comply with Section 2.1.5 of the GSMM (Volume 2).

Hydraulic Methods (4.2)

- For conveyance system calculations … Chapter 4 of the GSMM (Volume 2).

Post Construction Phase (1.1)

- After construction prepare As-Built Survey and
- After construction prepare As-Built Design Certification
- Adjust stormwater structures if necessary
- Execute stormwater inspection and maintenance agreement for all private onsite stormwater management facilities
- Secure Certificate of Occupancy/Final Plat
- File a Notice of Termination (NOT) with the State

MATERIALS & BMPs (3) – plan review

Conveyance Structures (3.1)

Pipes

- Pipes within the Public Right-of-Way & Dedicated City Easements – RCP, >/=18" dia, >/=12" cover in grass/sidewalk
- Other Pipe Systems: RCP or HDPE; 12" cover or manufacturer's requirements; 3' cover if on residential property line

Channels

- Designed for appropriate velocities, side slopes 3:1

Inlets

- GDOT materials and methods; City details preferred, GDOT details acceptable for City owned structures.
- HWs or FESs required on inlet and outlet ends.

Detention Ponds (3.2)

- In S/D's, ponds on separate lots
- Outlet structures concrete (or pipe)
- EMS required at or above 100-yr stage

Dry Earthen Detention Ponds

- Provide positive drainage on the pond floor, slope maximum 3:1
- A six-foot chain link fence with 20' clear around (can reduce to 4' high on front yard), double drive-thru maintenance gate where depth is >6' (pond bottom to top of berm/dam)

Dry Underground Detention Ponds

- Considered on non-residential development projects where aboveground detention pond is infeasible, meeting an H-20 loading

Wet Detention Ponds

- See 3.2.1 of the GSMM (Volume 2), submit a water balance simulation

Water Quality Best Management Practices (3.3)

GSMM (Section 4, Volume 2)

$$WQ_v = \frac{(P)(R_v)(A)}{12}$$

- Water Quality Volume Required = xxxx AC-FT
- Water Quality Volume Provided = xxxx AC-FT
- Proprietary Structural Controls - The City may allow proprietary controls