



Legislation Details (With Text)

File #: 15-0148 **Version:** 1 **Name:**

Type: Agendas **Status:** Passed

File created: 4/29/2015 **In control:** Board of Aldermen

On agenda: 5/19/2015 **Final action:** 5/19/2015

Title: Update on Storm Water Flooding Issues

PURPOSE: The purpose of this item is to provide the Board of Aldermen an update on various storm waste flooding issues since the last report on September 16, 2014

Indexes:

Code sections:

Attachments: 1. TOC PW_, 2. Tom's Creek, 3. 1020 MAIN, 4. Broad St, 5. Old_Pittsboro, 6. Morningside Dr, 7. February 11, 2014 Storm Water Design Agenda Item Abstract.pdf, 8. May 20, 2014 Storm Water Flooding Issues Agenda Item Abstract.pdf, 9. September 16, 2014 Storm Water Update Agenda Item Abstract.pdf, 10. Summary Storm water flooding mitigation projects May 2015, 11. CIP Storm Water Flooding Mitigation

Date	Ver.	Action By	Action	Result
5/19/2015	1	Board of Aldermen	accept the report	Pass

TITLE:

Update on Storm Water Flooding Issues

PURPOSE: The purpose of this item is to provide the Board of Aldermen an update on various storm waste flooding issues since the last report on September 16, 2014

DEPARTMENT: Public Works

CONTACT INFORMATION: George Seiz, Director of Public Works, 918-7427

INFORMATION:

The Board of Aldermen (BOA) asked staff to provide periodic updates on the Storm Water Mitigation projects. Updates have been provided on February 11, 2014, May 20, 2014 and September 16, 2014. The abstracts from the previous updates can be found as attachments.

Preliminary engineering studies and cost estimates have been completed by Sungate Design, Inc. for six project locations at a cost of \$26,500. The preliminary estimates were included as part of the FY 15/16 Capital Improvement Plan (CIP) and are included as an attachment. Also included as an attachment is a summary table providing a description of proposed improvements, cost estimates for design and construction, and comments about flooding impacts and priority.

How these projects are to be funded still needs to be determined. At this point in time funding has not been budgeted as staff looks at possible funding options. The two options noted in the CIP are: 1) pay as you go, 2) Assessment. One of the purposes of this report is to discuss the idea of assessing properties upstream of the

proposed improvements which contribute storm water.

The six locations that have been studied are shown below with updates.

I. PUBLIC WORKS GARAGE STREAM BANK STABILIZATION UNNAMED TRIBUTARY TO MORGAN CREEK

During the storm event of June, 2013 the stream bank of the Unnamed Tributary to Morgan Creek experienced severe erosion due to excessive velocities in the stream at the outlet of the 8' X 8' box culvert under NC 54 Bypass. The property line of the Town's Public Works facility runs down the middle of the stream. The erosive velocities left the banks on the Public Works side of the stream on an extremely steep slope and in an unstable condition. Further erosion could cause damage to a shed and other structures on the Public Works property.

In order to stabilize the eroded bank, the stream will first need to be restored to a more stable geometric pattern followed by installation of non-erosive bank stabilization (Class II rip rap). At the same time, a suitable energy dissipater will also need to be installed at the outlet of the existing culvert to prevent further stream bank erosion. In order to accomplish this work, additional easements will be required from the adjacent property owner. NCDOT has been contacted, and they agree that simply attempting to stabilize the bank on the Public Works property without installing the dissipater may not prevent further erosion to the stream bank and may also cause erosion of the stream bank on the eastern side of the stream. There are indications that NCDOT may be willing to participate to fill and protect the scour hole.

Project cost - \$127,900 to do the one side adjacent to Public Works

Also to be considered is the future replacement of the culvert pipes under the Public Works driveway entrance. The existing corrugated metal pipes are in poor condition and will eventually need to be replaced. **Project cost - \$210,000**

II. TOM'S CREEK FLOODING

Since 1982, flooding along Tom's Creek during Hurricanes, Tropical Storms and heavy localized storms which caused damage to existing structures have been reported. The latest was a localized rainfall event in June of 2013. Over the years, numerous studies have been conducted by Carrboro staff, the US Army Corps of Engineers and others in an effort to abate the flooding problem. To date, none of the potential solutions have been implemented due to either environmental concerns or funding issues.

There are four road crossings on Tom's Creek which create backwater. The development was designed prior to the current standards in a variety of ways, including the sizing of culverts. The enlargement of these culverts could cause more frequent downstream flooding during smaller storm events since the new culverts would not provide as much detention of storm water. Since overtopping of the roads is now occurring and would not occur after installation of the new culverts, the increased frequency of flooding cannot be quantified without a detailed Hydrologic Study of the watershed.

It should also be noted that these projects are mostly focused on the issue of eliminating or mitigating flooding effects on insurable structures. The Town may want to consider further analysis dealing with issues about the channel itself and whether or not there might be strategies that would allow maximizing access of the stream to its natural floodplain, and possibly assist with meeting other water quality concerns.

- A. West Main Street - West Main Street is an NCDOT road. Increasing the culvert size would not mitigate upstream flooding problems. Even removing the culvert and the existing road fill in its entirety would not remove flooded structures from the floodplain.
- B. Lorraine Street - There is currently a 66" pipe under Lorraine Street on Tom's Creek. The pipe is in poor condition with a corroded invert and sectional deformity likely caused by structural overload. The culvert currently causes backwater in the 100-year storm event which causes Lorraine Street to overtop. If the pipe size were to be increased to a 96" RCP, the 100-year water surface elevation would be lowered so that 400 Lorraine, 204 James, 206 James and 208 James would be removed from the 100-year flood plain.
- C. Carol Street - There are 2 @ 36" pipes currently under Carol Street on Tom's Creek. The culverts currently cause backwater in the 100-year storm event which causes Carol Street to overtop. If the pipe were to be upsized to a 72" RCP, the 100-year water surface elevation would be lowered so that 116 Carol, 118 Carol and 300 James would be removed from the 100-year flood plain.
- D. Rainbow Drive - There are 2@ 30" pipes currently under Rainbow Drive on Tom's Creek. The culverts currently cause backwater in the 100-year storm event which causes Rainbow Drive to overtop. If the pipe were to be upsized to a 72" RCP, the 100-year water surface elevation would be slightly lowered; however no dwellings would be removed from the 100-year flood plain. This is due to the fact that the existing elevation of Rainbow Drive at the culvert is considerably lower than either Carol or Rainbow; and therefore, overtopping of the road already or currently occurs earlier in the storm event. Once the road is overtopped the elevation of the flood increases much slower since the conveyance over the road is much greater than through the culverts. The fact that no dwellings will be removed from the 100 year flood plain raises the question as to the benefit of enlarging this culvert.

Consider enlarging culverts at three locations - Lorraine, Carol, and Rainbow.

Lorraine - replace 66" pipe with 96" pipe. Project Cost - \$113,500

Carol - Replace 2-36" pipe w/72" pipe. Project Cost - \$110,800

Rainbow - Replace 2- 30" pipes with a 72" pipe. Project cost - \$80,600

III. 1020 WEST MAIN STREET DRAINAGE COMPLAINT

In April, 2010 the property owner at 1020 West Mail Street reported that his crawl space and his adjacent neighbor's property were being flooded due to back up of storm water from downstream property, Calvary Baptist Church. Drainage from the 1020 West Main property is conveyed across the Church property in an existing 24" storm system. In December, 2013, the property owner again registered a complaint about his crawl space and shed being flooded by recent rains. He stated that in his opinion, upstream development and associated impervious surface were causing increased runoff and exacerbating his flooding problems.

Because the storm sewer which is backing up is located on private property, there is some question as to whether the Town is legally responsible for this problem and further research on this question is needed.

Four Alternatives were evaluated.

Alternative #1 would be to construct a 3 foot base overflow ditch from the properties to the existing drainage system in West Main Street. The ditch would parallel the access drive to West Main Street and would tie into the existing 42" drainage system in West Main Street. The ditch would be constructed exclusively on the Calvary Baptist Church property. There have been no discussions with the church as to the availability of the property for drainage ditch construction. This alternative and all others will reduce flooding in all storms up to the 100-year below the elevation of the crawl space, HVAC units and the shed. It is not anticipated that there will be downstream impacts since these alternatives tie directly into the existing drainage system in West Main Street.

Alternative #2 consists of replacing a portion of the existing 24" pipe system on the church property with a 3 @ 36" pipe from the properties to the existing storm drop inlet on the church property and then extending the system to the existing driveway and then continuing under the existing access drive to the drainage system in West Main Street. In order for the pipe system to work, the invert at the inlet of the system will have to be lowered by approximately 1.5 feet.

Alternative #3 would combine alternatives #1 and #2 and consists of construction of a 3 foot base ditch from the properties to the outlet of the existing 24" system on the church property and then constructing a new system 2 @ 42" system in the existing shared driveway to tie into the existing system in West Main Street.

Alternative #4 would be to install one or more detention facilities in the watershed. Due to the density of development and the lack of open space, this alternative was not considered to be feasible.

**Option 1 - remove existing 24" and construct a drainage ditch the entire distance to Main St.
Project cost - \$121,600**

**Option 2 - Replace existing 24" pipe with three - 36" pipes and tie into an existing storm system
in W. Main St. - Project cost - \$323,400**

Option 3 - Ditch and pipe combination - Project Cost - \$221,600

IV. 408 BROAD STREET CULVERT

During a June 30, 2013 storm, Broad Street was overtopped by flooding and a portion of the downstream embankment was washed away. There is a 24" pipe under Broad Street at this location. The subject culvert crossing is located near 408 Broad Street. The pipe crossing is located on Tanyard Branch which is a tributary to Bolin Creek. There is no flooding on adjacent properties up or downstream of the 24" pipe which cause damage to any existing structures.

The 24" pipe will not pass the 2-year storm based on the proposed zoning conditions in the contributing watershed without overtopping the road. This does not meet the current Town of Carrboro standard for cross pipes. In order to meet current Town of Carrboro standards, which require passage of the 25-year storm, the pipe will have to be upsized to a 54" RCP with a headwall on the inlet end. In addition, the 54' pipe provides enough conveyance so that the road will not be overtopped in the 100-year storm event; thereby, eliminating the

slope stability problem.

Option 1 - Replace existing 24” culvert with a 54” culvert that will meet current Carrboro Standards and not overtop the road in the 100 year storm. The existing culvert is comprised of two different pipe materials; roughly half is vitrified clay pipe and the other half plastic (HDPE). The existing inlet is partially crushed. - Project cost - \$43,000

Option 2 - Leave the existing pipe in place and provide a non-erodible road surface and downstream fill slope. Project cost - \$22,000

V. OLD PITTSBORO ROAD DRAINAGE

In August, 2000, it was reported by a property owner on Old Pittsboro Road that storm water from recent rainfalls had overtopped the ditch at her drive pipe and washed through her yard causing erosion on her property. There was no flood damage to the dwelling or any utilities or ancillary structures located on the property. On July 30, 2013 we received photos showing flooding on property, 100 Carr Street, at the intersection of East Carr Street and South Greensboro Street. The reported flooding was likely caused, in part, by the inadequate size of the storm drain outlet system under South Greensboro Street. It was also reported that storm water flow from the Old Pittsboro Road ditch overtopped the ditch and flooded the road. Flooding in Old Pittsboro Road had been reported on several other occasions between 2000 and 2013.

Four Alternatives were evaluated.

Alternative #1 would be to construct an adequately sized drainage system within the existing ditch in Old Pittsboro Road from the existing system in South Greensboro Street past 108 Old Pittsboro Road. The proposed system would consist of 60” and 66” pipes along with grated inlets at the drive locations installed in the ditch. Installation of an adequately sized system would eliminate flooding problems on 100 Carr Street and along Old Pittsboro Road.

Alternative #2 would be to construct an adequately sized drainage system (as in Alternative #1 from the existing drainage system in South Greensboro Street under Old Pittsboro Road tying into the exiting ditch beyond 108 Old Pittsboro Road.

Alternative #3 would be to reshape and lower the ditch along Old Pittsboro Road to add more conveyance to the ditch and to facilitate installation of the 60” pipe at the existing junction box in South Greensboro Street as in Alternatives #1 and #2. The ditch would need to be approximately 6 feet deep. This would make the top of the ditch approximately 36 feet wide at the top which would require significantly more Right-of-Way; would require removal most of the mature vegetation on the north side of the road; would require purchase and removal of an ancillary structure and would closely encroach on two dwellings.

Alternative #4 would be to install a detention facility in the watershed. The site considered for location of the detention facility is the Town owned property at the north corner of South Greensboro Street and Carr Street. An underground storm water BMP could be installed beneath the proposed building for the site. This could provide significant storm water storage and possibly cut the peak discharge to levels that the existing ditch and pipe system along Old Pittsboro Road could handle.

Option 1 - Construct adequate size drainage system - connect to existing system that discharges to the west of S. Greensboro, and run pipe to 108 Old Pittsboro where existing ditch widens and

slope increases to keep water contained. - Project cost - \$453,400

Option 2 - Same as option 1 but with different alignment out in public right-of-way. - Project cost - \$566,800.

Options 3 & 4 possibly not feasible and Option 4 (large underground detention facility) would likely cost much more than either Option 1 or 2.

MORNINGSIDE DRIVE STORM DRAINAGE UPGRADES

The property owners at Lots 103, 105, and 107 Morningside Drive experience periodic nuisance flooding of the land adjacent to Morningside Drive. None of the structures located on the lots have experienced flood damage above the finished floor elevation. However, the flooding does impact the accessibility to the structures located on Lots 103 and 105 when the associated driveways are inundated. There is an existing single 24” RCP under Morningside Drive and is undersized for the contributing watershed. Based on the calculated peak flow rates, Morningside Drive overtops in less than the 1-year storm event.

In order to convey the 25-year storm event without overtopping the roadway, three 30-inch RCP open-end pipes would be required. Multiple pipes would be needed due to limited elevation difference between the channel bed and roadway surface. Storm events greater than the 25-year event, would continue to overtop the existing road. While increasing the number and size of the cross-pipes will reduce the frequency of flooding on the Lots, the low areas on the Lots will still be inundated periodically unless the driveway and parking areas are raised above the elevation of the roadway sag. The pipe under the driveway to Lot 105 will also need to be replaced by the property owners with a larger appropriately sized pipe.

Project would replace existing 24” culvert with 3 - 30” culverts. Some curb and gutter work in combination with the installation of a catch basin to control water coming off of street.

Project cost - \$100,200.

VI. Mitigation Grants for Flood-prone properties

The Town submitted applications in October 2013 for Hazard Mitigation Assistance (HMA) grant funding for four flood prone properties in the Tom's Creek basin; a requirement of the grant funding was that each property was already flood-insured. Funding was not allocated. In August 2014, staff learned that additional funding was available for local governments in Orange and Alamance Counties. A letter of interest was prepared in September. The letter identified \$2,697,798 in projects including: funding for generators to control traffic lights, funding for generators to serve Town Hall, and funding for culvert replacement and the elevation and acquisition projects applied for previously. In December, the Town was notified that the elevation and acquisition projects were approved to be submitted as grant applications under the Hazard Mitigation Grant Program (HMGP), with the 25 percent non-local match to be provided by the State of North Carolina. Applications for four properties, seeking \$748,392 in grant funds, were submitted in April 2015, as follows:

	Acquisition	Elevation
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1	100 James Street	400 Lorraine Street
2	116 Carol Street	403 Lorraine Street

Funding:

As noted in the beginning of this report funding for these projects still needs to be determined. One option to possibly consider is assessing some or all of the cost to the properties that benefit from the projects. According to State Statute 160A-216, the Town would have the authority to make a special assessment for the types of improvements noted above. Pertinent statutes are shown below:

160A-216. Authority to make special assessments.

Any City is authorized to make special assessments against benefited property within its corporate limits for: Constructing, reconstructing, extending, and other building or improving storm sewer and drainage systems.

State Statute 160A-218. Basis for making assessments

Assessments may be made on the basis of:

1. The frontage abutting on the project, at an equal rate per foot of frontage, or
2. The area of land served, or subject to being served, by the project, at an equal rate per unit of area, or
3. The value added to the land served by the project, or subject to being served by it, being the difference between the appraised value of the land without improvements as shown on the tax records for the county, and the appraised value of the land with improvements according to the appraisal standards and rules adopted by the county at its last revaluation, at an equal rate per dollar of value added; or
4. The number of lots served, or subject to being served, where the project involves extensions of an existing system to a residential or commercial subdivisions, at an equal rate per lot; or
5. A combination of two or more of these bases.

Whenever the basis selected for assessment is either area or value added, the council may provide for the laying out of benefit zones according to the distance of benefited property from the project being undertaken, and may establish differing rates of assessment to apply uniformly throughout each benefit zone.

For each project, the council shall endeavor to establish an assessment method from among the bases set out in this section which will most accurately assess each lot or parcel of land according to the benefit conferred upon it by the project. The council’s decisions as to the method of assessment shall be final and conclusive and not subject to further review or challenge.

One approach would be to determine layers or levels of benefit and subsequent assessment. So as an example, if the all properties that contribute water to a drainage area were considered to benefit the same by the installation of a culvert(s), a simplified calculation would be to take the entire area of land served, divided by the cost of the project and determine a cost per acre which would then be applied to the acreage of each lot. The Town may also want to consider that there is some overall public benefit, pay a portion of the cost from tax

revenue and assess the remaining portion against those benefitted, or possibly even consider various levels of benefit such as a higher level of assessment to those that may be closer to the project and receiving a higher level of benefit.

Attached are drawings showing the drainage areas in various project locations. Example calculations of the cost per acre of the various projects are as follows assuming the cost of the entire project being assessed against the property owners. An average acreage per property is shown for example purposes only knowing that in some areas lot sizes could vary significantly.

Public Works Stream Bank - $\$127,900/363.8 \text{ acres} = \356 per acre 889 properties Ave. 0.4 acres per property.

Tom's Creek - All three culverts - $\$304,900/497 \text{ acres} = \613 per acre 235 properties Ave. of 2.1 acres per property.

1020 Main Street - Option 1 - $\$121,600/20.1 \text{ acres} = \$6,050 \text{ per acre}$ 83 properties Ave. of 0.24 acres per property

400 Block of Broad Street - Option 1 - $\$43,000/19.5 \text{ acres} = \$2,205 \text{ per acre}$ 47 properties Ave. of 0.41 acres per property

Old Pittsboro Road - Option 1 - $\$453,400/32.9 \text{ acres} = \$13,781 \text{ per acre}$ 104 Properties Ave. of 0.32 acres per property.

Morningside Drive - $\$100,200/32.5 \text{ acres} = \$3,083 \text{ per acre}$ 64 Properties Ave. of 0.51 acres per property

FISCAL & STAFF IMPACT: The fiscal impact to the Town is unknown at present and will be determined ultimately by decisions about the extent and scope of projects in relation to their costs and benefits and the financing methodology used to fund any projects. The Town will be exploring different funding strategies and options for storm water management over the next year.

RECOMMENDATION: It is recommended that the Board of Aldermen accept the report