Environmental Assessment

City of Titusville Flood Protection Project

Major Disaster Number FEMA-1485-DR

Prepared for the Department of Homeland Security
Federal Emergency Management Agency
Region 3, Philadelphia, PA

Prepared by the Commonwealth of Pennsylvania
Department of Environmental Protection
Bureau of Waterways Engineering
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1.0 PURPOSE AND NEED FOR ACTION

1.1 Introduction

The City of Titusville has applied for Hazard Mitigation Grant Program (HMGP) funding to the Federal Emergency Management Agency (FEMA) made available following Major Disaster 1485 that occurred in 2003. The HMGP funding would be used to partially pay for construction of a Commonwealth of Pennsylvania flood protection project for the City of Titusville that was authorized by Act 8, as signed into law by the Governor of Pennsylvania on July 11, 1996. The HGMP is authorized by the Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 United States Code 5121-206 as amended, and is administered by the Pennsylvania Emergency Management Agency. The HGMP funding requires matching funds from the grant applicant and would be combined with Commonwealth of Pennsylvania funds to accomplish the proposed action.

This Environmental Assessment was prepared in accordance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality (CEQ) regulations implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508), and FEMA's regulations (44 CFR Part 10, Environmental Considerations). These laws and regulations require FEMA to take into account environmental considerations when funding any Federal action. These laws and regulations are analogous with the Dam Safety and Encroachments Act, Title 32, Pennsylvania Statutes, Sections 693.1-693.27; the Clean Streams Law, 35 P.S. §§ 691.1-693.1001; and the Dam Safety and Waterway Management Rules and Regulations, Title 25, Pennsylvania Code, Chapter 105.

1.2 Location and Background

Church Run in Crawford County, Pennsylvania (Figure 1); is a tributary to Oil Creek and drains an approximately 4.5 square mile area that is located in the Pittsburgh Low Plateau Section of Appalachian Plateaus Physiographic Province (Figure 2). Approximately 85 percent of the Church Run watershed is located in Oil Creek Township where landuse is predominantly forested or agricultural. Landuse in the remaining 15 percent of the watershed is urban and lies within the City of Titusville. The urban area in the City of Titusville represents the area affected by flooding (Figure 3).

Church Run flows under 16 street bridges/culverts, three railroad crossings, two pedestrian bridges and flows through one stream enclosure within the City limits. All of the bridges/culverts over Church Run in the City of Titusville are overtopped during large storm events (Figure 4). Fourteen of the bridges pass less than a five-year frequency flood event. None of the bridges have a capacity greater than a 25-year flood event (Commonwealth of Pennsylvania, 1991). Concrete or masonry walls line the streambanks within the City limits. At several locations along the stream channel, structures were built on top of the walls and the walls serve a dual purpose as house foundations (Figure 5). Most of the existing walls are in poor structural condition. Several sections of wall are severely deteriorated and some have collapsed during recent flooding events.

In the past, flooding of Church Run has generally coincided with flooding on Oil Creek. Flood events occurred in 1946, 1948, 1954, 1959, 1969, 1972, and 1987 when overbank flows affected structures located along the floodplain of Church Run. Also, overbank flows from Church Run divert along Franklin and Martin Streets and residents have reported a two-foot depth of flow down Martin Street. These diverted overbank flows flood areas in the business district located in the vicinity of Franklin, Mechanic and Water Streets. Damages were sustained in this commercial area where, for example, a furniture store had approximately 2 feet of water on the main floor in 1987. A similar flood event occurred on July 15, 1990, when approximately 300 residents and 50 businesses experienced flooding (Commonwealth of Pennsylvania, 1991). The most recent flooding occurred on July 21, 2003 when approximately 4 ½ inches of rain fell on the area.

The Commonwealth of Pennsylvania Flood Protection Study (1991) considered the feasibility of a flood protection project along Church Run. The purpose of the study was to analyze the flooding conditions along Church Run in the City of Titusville and determine what protective measures could be implemented to avert future flood-related damages. Benefit-cost ratios were considered for several project alternatives using flood damage reduction benefits and construction costs as a measure. The study recommended constructing a detention dam upstream of the City of Titusville to reduce flood damages. The proposed project was never constructed. After flooding occurred on July 21, 2003, the City of Titusville requested funding assistance from FEMA and the Commonwealth to assist with completion of the proposed action.

1.3 Purpose and Need

The need for action is articulated in the Location and Background section, which outlines recurring flood events that have caused much damage in downtown Titusville. The purpose of the action is to alleviate flooding and reduce public and private property damage in the City of Titusville during storm events in the Church Run Watershed.

2.0 ALTERNATIVES

CEQ and FEMA's NEPA implementing regulations direct FEMA to investigate and evaluate project alternatives. The next section documents, in detail, the alternatives that were analyzed. The alternatives are nearly identical to the Commonwealth of Pennsylvania Flood Protection Study (1991).

2.1 Alternatives Analyzed in this EA

Five alternatives were considered and are documented. The alternatives are presented in Table 1 and each alternative is described in great detail in the subsequent text.

Table 1. Alternatives

Alternative	Description
A	No Action Alternative
B	Detention Dam
C	100-yr Concrete U-Channel
D	50-yr Concrete U-Channel
E	Detention Dam plus Concrete U-Channel

2.1.1 Alternative A – No Action Alternative

The no action alternative would allow current conditions to remain.

2.1.2 Alternative B –Detention Dam

The preferred Alternative B involves constructing a detention dam to reduce flood flows and a suitable site for a detention dam is located immediately upstream of the City Titusville boundary in Oil Creek Township (Figure 6). Dam construction activities will affect approximately 3 acres. The flood inundation area upstream of the proposed detention dam would be approximately 9 acres and this area would be acquired by the City of Titusville, or a permanent easement would be obtained from the property owners. A total of approximately 3 acres within the flood inundation zone would be utilized to construct replacement wetlands. All of the areas currently are undeveloped and used as a cattle pasture.

The proposed structure would not have a permanent pool because water would be stored only during above normal rainfall conditions. The detention dam would detain floodwaters up to and including the 100-year flood and release them at a reduced rate. The dam would be constructed of roller compacted concrete (RCC) and have a maximum height of 26 feet. Roller compacted concrete dams can be safely overtopped. A 150-foot conduit would be installed within the existing stream channel to allow normal flow to pass through the dam. [see Appendix – for dam design]. Should a larger than 100-year flood occur, the crest of the dam would function as a spillway.

Upon completion of the project, the FEMA floodplain maps would be appropriately amended to reflect project outcome in terms of changes in flood risk. Up to a 100-year event, flood flows on Church Run would no longer exceed the capacity of the Franklin and Martin Street bridges. Overbank flows that produce a large inundation area in the residential and business district of the City of Titusville that is not located in the mapped floodplain of Church Run would be eliminated. Over 300 homes and businesses would be spared from floodwaters once the dry dam is functioning. The dry dam would significantly reduce flood damages to residents and businesses in the City of Titusville.

The benefits of a flood protection project to a community are equivalent to the reduction of flood damages. The "Flood Damage Assembly Program" is a U.S. Army Corps of Engineers program was used to predict flood damages for residential properties. Amortized annual costs were computed assuming a 50-year project life, and a state rate for bonds of 7.5%. Damages were computed for floods of different magnitudes. Average annual damages were determined by plotting damages with their respective yearly occurrence and using a graphical procedure to develop flood damage probability curves.

The average annual cost of construction of the project is $170,000.00. The average annual flood damage prevented is $192,000.00. Adjusting these for inflation of 4% and using an interest rate of 7.5%, yields a sum of the present value of flood protection to be $4,615,000.00. The estimated construction cost of the project is $2,200,000.00. This means the dry detention dam would return approximately $2.10 in flood damage prevention for every one dollar of construction cost.

2.1.3 Alternative C – 100-Year Concrete U-Channel

Alternative C is a 6,200 foot long concrete U-channel having a hydraulic capacity to accommodate the 100-year design flood of 1,600 cubic feet per second (Figure 6). A U-channel is a rectangular-shaped and concrete-lined channel having a horizontal channel invert and vertical walls. The channel dimensions required for Church Run would be a bottom width of 17 feet and walls 5 to 6 feet high. The wall height would include 1.0 foot of freeboard above the depth of the 100-year water surface. The project length of 6,200 feet would extend from a small debris basin north of the city to a stilling area downstream of Water Street. Final design plans have not been developed for Alternative C.

All 21 of the existing bridges would have to be removed for this project and new bridge decks across the U-channel would be required. The new concrete channel walls would incorporate the bridge deck abutments. Realigning the channel would be required at Franklin Street, Martin-Walnut Street, and Brown-Water Street. In order to maintain the required width of the channel, a number of homes adjacent to Drake Street, Martin Street and Hemlock Alley would have to be acquired and removed. The exact number of homes cannot be specified until the design phase of a project when the final alignment is determined. For example, upstream of Drake Street, the house on the east bank or the west bank, or possibly both homes, may have to be removed. However, a design objective would be to minimize removal of existing homes. In addition to the houses, the

barn upstream of Linden Place and a few garages and sheds located on the streambanks would be removed.

The average annual cost of construction of the U-channel project is $432,000.00. The average annual flood damage prevented is $234,000.00. Adjusting these for inflation of 4% and using an interest rate of 7.5%, yields a sum of the present value of flood protection to be $5,625,000.00. The estimated construction cost of the project is $5,600,000.00. This means the dry detention dam would return approximately $1.00 in flood damage prevention for every one dollar of construction cost.

2.1.4 Alternatives Considered But Not Carried Forward

2.1.4.1 Alternative D - Concrete U-Channel with 50-Year Flood Capacity

Alternative D consists of constructing a concrete U-channel designed to handle the 50-year flood flow of 1,250 cubic feet per second (cfs). The width requirement of 15 feet would reduce the number of bridges to be replaced when compared with Alternative C. Wall heights would remain the same as in Alternative C. An improved inlet to keep flood flows from bypassing the concrete channel is required. This inlet to the concrete channel would be located immediately upstream of the Union Street Medical Center. This alternative requires removal of a residential structure upstream of the Medical Center. The bridges that would have to be replaced under this alternative are listed in Table 2.

Table 2. Alternative D-Structures requiring replacement.

	Structure	Action
1.	Spruce Street	Replace bridge deck
2.	Martin-Walnut Street*	Replace bridge decks on new alignment
3.	Drake Street	Replace bridge deck
4.	Kerr Street	Replace bridge deck
5.	Footbridge between Kerr and Main Streets	Remove but not replace
6.	Sidewalk bridge adjacent to Brown Street	Remove but not replace
7.	Spring Street	Remove but not replace
8.	Abandoned Railroad Spur	Remove but not replace
9.	Two Railroad bridges and Brown-Water Street	Replace bridge decks on new alignment

An existing culvert is located under the front yard of a residential property at the corner of Martin and Walnut Streets. The new alignment would be located to avoid this residential property as much as possible. The 50-year project alternative would have a shorter reach than Alternative C. The channel would begin upstream of Union Street and

continue 5,100 feet to a concrete or derrick stone stilling area downstream of Water Street. Although this alternative costs significantly less than Alternative C, it was eliminated because it would not provide sufficient flood protection during 100-year events.

2.1.4.2 Alternative E - Detention Dam Plus U-Channel

The last flood protection alternative considered was an upstream detention dam (as previously described) in conjunction with a downstream concrete U-channel to provide full 100-year protection. Although it was desirable to minimize the cost of the downstream component, the lack of clear space along the streambanks and the low capacity of existing bridges required the use of a concrete channel for accommodating the reduced flow. This U-channel would begin at Franklin Street and extend downstream to East Main Street and have a bottom width of 10 feet. From Main Street to below Water Street, the channel width would increase to 15 feet. Average wall height for the 4,080-foot-long channel is approximately 4.5 feet.

The average annual cost of construction of the project is $401,000.00. The average annual flood damage prevented is $234,000.00. Adjusting these for inflation of 4% and using an interest rate of 7.5%, yields a sum of the present value of flood protection to be $5,625,000.00. The estimated construction cost of the project is $5,200,000.00. This means the dry detention dam would return approximately $1.08 in flood damage prevention for every one dollar of construction cost. This benefit-cost ratio is lower than that of the detention dam alone, and therefore is not a feasible option.

3.0 AFFECTED ENVIRONMENT, PROJECT IMPACTS AND CONSEQUENCES

The Church Run Watershed would be affected and the following sections characterize the existing watershed. The environmental consequences of Alternatives A, B, and C; and details of the potential effects on the physical and natural resources within the project area are discussed in the following sections. Discussions include the direct, indirect and cumulative effects.

Discussion for the following environmental assessment categories is not included herein:

- Air Quality
- Coastal Zone Management/Barrier Resources
- Wastes and Hazardous Materials
- Groundwater
- Infrastructure
- Noise
- Visual Resources

These categories are not included given that, for all of the alternatives, the project would not have an affect on them.

3.1 Soils, Geology and Seismic Analysis

Valley soils in the Church Run Watershed are primarily glacial drift of Illinoian age. Most soils encountered in test borings at the proposed Alternative B detention dam site are sandy gravel or gravelly sand with minor fines. Two horizons of laminated clay were encountered in borings from the valley center to the right side of the valley. Springs are common along the right side of the valley near the base of its slope. Deep leaching of the glacial drift has occurred (Commonwealth of Pennsylvania, 1991).

Holly-Red Hook-Chenango association of soils occur along smaller streams in Crawford County. The Soil Survey of Crawford County created by the United States Department of Agriculture (USDA) identifies Holly series soils upstream of the City of Titusville limits. This series consists of deep, poorly drained to very poorly drained, nearly level soils located on floodplains (USDA Soil Conservation Service, 1979). Results of the Routine Wetland Determination (Appendix B) for the proposed detention dam (Alternative B) confirm the presence of Holly series soils. The USDA, Natural Resources Conservation Service (NRCS) does not classify Holly soils as Prime or other Important Farmlands in Crawford County, Pennsylvania.

Within the City of Titusville limits, where urban landuse predominates throughout the floodplain, soils are identified as Hanover and Haven series soils (USDA Soil Conservation Service, 1979). The present day soils are more likely to be consistent with soils in the Urban series because they are covered with streets, parking lots, buildings and other structures typical of urban areas. Hanover and Haven series soils are classified as Prime or other Important Farmlands in Crawford County, Pennsylvania.

Bedrock near the Alternative B detention dam site consists of near-horizontal layers of weathered shale, siltstone and sandstone of the Pocono Group. At the dam site, bedrock crops out only along the left bank of Church Run. Between Church Run and SR 0089, depth to bedrock is roughly 20 feet. The bedrock surface dips generally toward the right side of the valley, where depth to rock is about 40 feet. Rock was not encountered in a 68-foot deep test boring on the right abutment of the dam site.

The closest earthquake epicenters are located west and northwest of Titusville. The 1998 Jamestown earthquake was the largest recorded in Pennsylvania (magnitude 5.2). Jamestown is located about 40 miles west of Titusville. Earthquakes in Erie County were farther from Titusville than the one, which occurred near Jamestown. Most Erie County earthquakes seem to be part of a linear pattern of epicenters centered in Ohio, and roughly following the shore of Lake Erie.

Within Pennsylvania, there is an approximate 100-mile gap between the aforementioned activity, and a few widely scattered epicenters located to the southeast and east. The Lancaster Seismic Zone, which is perhaps the most active region in Pennsylvania, is located about 200 miles to the southeast of Titusville. In New York, the closest seismic activity has been near Buffalo and Attica.
Epicenter maps for Pennsylvania, Ohio, and New York can be viewed at the following websites.
Pennsylvania: http://www.dcnr.state.pa.us/topogeo/hazards/epimap.aspx
Ohio: http://www.dnr.state.oh.us/OhioSeis/html/earthmap.htm
New York: http://neic.usgs.gov/neis/states/new_york/ &
http://mceer.buffalo.edu/infoservice/faqs/default.asp

Earthquakes in Pennsylvania cannot generally be associated with the surface trace of faults. There are numerous faults in Pennsylvania with no known seismic activity nearby. It appears that most seismic activity is associated with deep-seated faults, many of which apparently do not extend to the surface. Because of this, the surface traces of faults are not very useful for predicting future earthquakes.

The USGS has used a probabilistic approach to produce ground motion maps for the eastern United States. Maps may be viewed at the USGS Earthquake Hazards Program website (http://earthquake.usgs.gov/hazmaps/). Those maps should be used with caution because site-specific conditions (soils especially) can affect the actual magnitude of ground motion. The maps show the peak accelerations (as percentage of gravity) that have a 2% and 10% chance of being exceeded in 50 years. At Titusville, the peak acceleration with a 2% chance of being exceeded is between 6% and 8% of gravity. Peak acceleration with 10% probability of exceedance is between 2% and 3% of gravity. The 6% to 8% acceleration roughly translates into a Modified Mercalli Scale intensity of VI. Ground motion of that intensity is felt by everyone and causes slight structural damage.

3.1.1 Alternative A-No Build Impacts and Consequences

Geology, soils or seismicity would not be affected because no construction would occur.

3.1.2 Alternative B-Detention Dam Impacts and Consequences

Geology would not be impacted by the construction of a detention dam. Soils would be impacted by this alternative. Excavation and stockpiling of site soils would occur at the location of the proposed detention dam. The Holly soils would be excavated for the purpose of constructing an impermeable foundation that ensures long-term structural stability. The soils would be stockpiled outside of existing wetlands and may be used to construct the upstream face of the detention dam. During the period when soils are stockpiled for future use, the soils would be contained using best management practices to prevent erosion. These measures would be consistent with the requirements of the National Pollution Discharge Elimination System (NPDES) permit program. Seismicity analysis indicates that special design criteria as required by the Dam Safety and Encroachment Act and regulations under Chapter 105 will not be necessary due to the site siesmicity only having a potential to cause only slight structural damage. This conclusion is based upon the determination that the site has a Modified Mercalli Scale intensity of VI.

3.1.3 Alternative C-100-Year Concrete U-Channel Impacts and Consequences

Geology would not be impacted by this alternative. Soils would be impacted, primarily within the urban areas of the City of Titusville. The soils that would be impacted are typical of Urban soils that are altered or obscured by structures to a degree that original soils are difficult or impossible to identify. The composition of these soils is highly variable. Based upon the characteristics of these soils, impacts would not be adverse. Some soil excavation and stockpiling would occur during construction of this alternative. During the period when soils are stockpiled for future use, the soils would be contained in some manner to prevent erosion. Measures to prevent erosion of soil stockpiles would be reviewed for consistency with the requirements of the National Pollution Discharge Elimination System (NPDES) permit program. Although the soils identified in the Soil Survey of Crawford County are listed as Prime or other Important Farmlands throughout the length of the proposed concrete U-channel, the construction of this alternative would not have an adverse affect on these soils and their designation as Prime or other Important Farmlands. Seismicity analysis indicates that special design criteria as required by the Dam Safety and Encroachment Act and regulations under Chapter 105 will not be necessary due to the site siesmicity only having a potential to cause slight structural damage. This conclusion is based upon the determination that the site has a Modified Mercalli Scale intensity of VI.

3.2 Past and Existing Watershed Landuse

Petroleum extraction during the oil boom of the 1850's and the Industrial Revolution changed the demographics and landuse of this region dramatically. The Oil Creek Watershed is commonly referred to as "The Valley That Changed the World" because of the rapid growth of the petroleum industry that was attributed to the Drake Well in Titusville (Owen, 1975; Dickey, 1959). Landuse associated with the early oil wells was

far different and had far greater impact on the environment than the agriculture and forest landuses that it replaced.

Today there are 20 active oil wells and 13 inactive oil wells in the Church Run Watershed according to the eFacts Database maintained by the Pennsylvania Department of Environmental Protection (Figure 7). Many of the active oil wells are not currently producing oil, although they remain in active status. The current impact on the environment from petroleum extraction is greatly reduced from the industrial era. Current landuse associated with the oil wells is similar to agricultural landuse.

Current landuse in this watershed can be lumped into three basic categories of urban, forest and agriculture. Approximately 60% of the Church Run Watershed is forest, 25% agriculture and 15% urban (Figure 8). The combination of agriculture and forest landuse dominates the upper portion of the watershed. The lower 15% of the watershed consists of urban landuse centered in the City of Titusville. Based upon aerial photograph interpretations of landuse changes between 1959 and 1993, landuse has not changed dramatically in the last 50 years throughout the Church Run Watershed.

3.2.1 Alternative A-No Build Impacts and Consequences

The no build alternative, leading to repeated flood damages, would have an adverse impact on existing urban landuse within the City of Titusville and agriculture and forest landuse beyond the urban areas. If abandonment of urban areas by current businesses or residents occurred because of repetitive flood damage, it is likely that practical urban landuse would discontinue. This will lead to adverse socioeconomic impacts on the City of Titusville tax base, economics, and community well being. It is possible that current residences and businesses affected by flooding could relocate outside of the urban boundaries of the City and push conversion of existing agriculture and forest landuse to urban landuse.

3.2.2 Alternative B-Detention Dam Impacts and Consequences

The agricultural landuse within the detention area would be converted to forest landuse. The result is that the total percentage of the agriculture landuse in the Church Run Watershed would decline from approximately 25% to 22% with a corresponding increase in forest landuse. Economic losses associated with reduced agricultural landuse are likely to be compensated by increased economic benefits from forest landuse. These landuse changes would not have a significant adverse impact on current landuse trends in the Church Run Watershed. Urban landuse would be sustained and may slightly increase within the City of Titusville. Sustaining the urban landuse would have a positive benefit to the City of Titusville tax base, economics and community well being.

3.2.3 Alternative C-100-Year Concrete U-Channel Impacts and Consequences

Alternative C would not affect agriculture or forest landuse in the Church Run Watershed. Urban landuse is not likely to change in terms of total watershed area. However, sustaining the existing urban landuse within the City of Titusville would result in similar benefits as Alternative B. Sustaining the urban landuse would have a positive benefit to the City of Titusville tax base, economics and community well being.

3.3 Floodplain Management (Executive Order 11988)

Executive Order 11988 (as promulgated in FEMA's regulations at 44 CFR Part 9) requires federal agencies to take action to minimize occupancy and modification of the floodplain. Specifically, EO11988 prohibits federal agencies from funding construction in the 100-year floodplain unless there are no practicable alternatives. For projects in or affecting the floodplain FEMA uses an eight step planning process to evaluate effects.

In 1977 a detailed Flood Insurance Study (FIS) was completed for the City of Titusville, Crawford, County. The principal result of the FIS was publishing:

- a Flood Insurance Rate Map (FIRM), Community Panel Number 420354 0001 B, Page 1 of 1, effective date February 15, 1978, to convert the City of Titusville to the regular program of flood insurance by the Federal Insurance Administration.

In 1990, a Flood Insurance Study was completed for Oil Creek Township, Crawford County. The principal result of the FIS was publishing the following items:

- Flood Insurance Rate Map, Map Index and Street Index, Community Panel Numbers 421568 0001-0010, effective date August 15, 1990.
- Flood Insurance Rate Map, Community Panel Number 421568 0004 B, Panel 4 0f 10, effective date August 15, 1990.
- Flood Insurance Rate Map, Community Panel Number 421568 0005 B, Panel 4 0f 10, effective date August 15, 1990.
- Flood Insurance Rate Map, Community Panel Number 421568 0006 B, Panel 4 0f 10, effective date August 15, 1990.
- Flood Insurance Rate Map, Community Panel Number 421568 0007 B, Panel 4 0f 10, effective date August 15, 1990.

As defined by the 1977 FIA Study for Titusville, the 100-year flood on Oil Creek has a water surface elevation of 1,179.5 feet at the mouth of Church Run. This flood elevation results in a backwater effect on Church Run bridges extending upstream to Central Avenue. The reach upstream of Central Avenue has low streambank protection and inadequate bridge capacities, which allow Church Run flood discharges to flow into the overbank areas. Every bridge structure along Church Run in the City of Titusville would experience overbank flows in the event of a 100-year flood along Church Run. These flows are generally not very deep because the moderate slope of the ground results in higher water velocity and lower water depths.

Overbank flows at the Franklin and Martin Street bridges are the most difficult to address. Once flows leave the channel, they continue down the respective streets that serve as conduits towards the business district of Titusville. These diverted floodwaters inundate low-lying properties within the commercial area of Titusville in particular the Franklin, Water, and Mechanic Street areas. Older structures, including a furniture store and a pizza shop, are subject to flooding as was experienced in July 1987, again on July 15, 1990 and again on July 23, 2003.

The computer program entitled "Water Surface Profiles," (HEC-2) developed by the U.S. Army Corps of Engineers, was used to study flood hydraulics along Church Run. The same procedure was followed in the 1977 FIA study to define the 100-year floodplain. Updated cross-sections of the stream were obtained by topographic field survey in the vicinity of the channel, and from topographic mapping provided by the City. Flood discharge rates were based on the analysis of watershed hydrology described in the previous section.

A 100-year flood inundation area was developed and is shown on Figure 10, of Appendix A. A 100-year flood inundation area is very similar to the 100-year floodplain defined by the FIA study (Commonwealth of Pennsylvania, 1991). The occurrence of flood waters leaving Church Run and flowing directly to the Oil Creek floodplain by way of Franklin Street and Martin Street cannot be accurately modeled with the HEC-2 program, which results in flood levels along Church Run being somewhat higher than what would occur under actual flood conditions.

3.3.1 Alternative A – No Action Alternative Impacts and Consequences

The no action alternative would allow the past flood problems experienced along Church Run to continue. Overbank flows from Church Run would continue to be diverted southward along Franklin and Martin Streets and inundate low areas of the business district located in the vicinity of Franklin, Mechanic and Water Streets. Also residents and businesses in the 100-year flood plain of Church Run would continue to be flooded.

3.3.2 Alternative B-Detention Dam Impacts and Consequences

The 100-Year Flood Inundation Map, Figure 10 of Appendix A, overlays the proposed detention dam site on the FIRM panel, which is in the floodplain. Portions of the area that would detain 100-year peak flow are also in the mapped floodplain. The proposed dam and detention basin are considered functionally dependent uses in the floodplain. Alternatives to siting the dam in the floodplain have been considered through preparation of this EA and the alternatives are not practicable.

The dry dam would detain floodwaters up to and including the 100-year flood and release them at a reduced rate. This would allow Church Run to pass under the bridges and culverts in Titusville without exceeding their flow capacity. The flood control dam would detain the 100-year peak flow of 1,300 cubic feet per second (cfs), and release the floodwaters at a rate of 97 cfs. This would eliminate the overbank flows that produce a large inundation area in the residential and business district of Titusville. This inundation area is not located in the floodplain of Church Run. Over 300 homes and businesses would be spared from floodwaters once the dry dam is functioning. An additional benefit would be the mitigating the 100-year floodplain of Church Run in the City of Titusville. In accordance with the National Flood Insurance Program (NFIP), a Letter of Map Revision would have to be prepared to revise the existing FIRM panel to reflect the new flood boundaries.

3.3.3 Alternative C-100-Year Concrete U-channel Impacts and Consequences

Alternative C also in the mapped floodplain, would eliminate the overbank flows that produce a large inundation area in the residential and business district of Titusville. Numerous homes would also be removed from the 100-year floodplain of Church Run to accommodate the U-channel or bridge replacements. This includes 4 historic homes along Drake Street, and up to 8 historic homes along Martin Street that would have to be removed. The channel improvements would be considered a functionally dependent use and would reduce the mapped floodplain. This also would require a Letter of Map Revision under the NFIP.

3.4 Water Resources and Water Quality

The project area is located along Church Run and its watershed is about 4.5 square miles. Church Run is a perennial flowing, coldwater stream that is primarily spring fed and discharges into Oil Creek. Water quality in Church Run is generally very good and the Chapter 93 (relating to the Commonwealth of Pennsylvania Clean Streams Law) designated water use is Cold Water Fishes (CWF). The CWF designation of Church Run indicates that the stream supports flora and fauna indigenous to cold-water habitats. The channel characteristics and water quality upstream of the City limits support a fishery dominated by wild brook trout (PA Fish and Boat Commission, 2005; Cooper et al. 1972; Dunn Geosciences Corporation, 1974; 1977). Water quality sampling dating to 1970's indicates that the water quality has been good for some time when Church Run had a pH of 6.9, low turbidity and low suspended sediment (Cooper et al. 1972; Dunn Geosciences Corporation, 1974; 1977). In light of the fact that landuse in this watershed has changed very little since the 1970's, current water quality is analogous. The Pennsylvania Department of Environmental Protection completed an assessment of Church Run in the year 2001 using a modified Rapid Bioassessment Protocol (Barbour, et. al. 1999). DEP determined that Church Run is meeting its CWF Chapter 93 designated use based upon the assessment in the year 2001 and that the resource is not impaired.

A hydrologic analysis was performed for Church Run to estimate flood flow rates for various probabilities of recurrence, including a 100-year flood discharge (i.e. a flood that has a one percent chance of occurring in any given year). The standard practice of the Department is to design flood protection structures to provide protection to the level of a 100-year flood. For the Church Run watershed, peak discharge determinations were made for the entire watershed area of 4.5 square miles.

Several hydrologic procedures were applied to compute discharge-frequency relationships for the watershed. The methods used were:

1. The Army Corps of Engineers' linear regression equations for the Pittsburgh Region.
2. The Soil Conservation Service hydrograph method, computed with the HEC-1 flood hydrograph program and utilizing PDT-IDF rainfall data and distribution.
3. The Pennsylvania State University's procedure PSU-IV for estimating design peaks on ungaged Pennsylvania watersheds.
4. The U.S. Geological Service's Bulletin 13 procedure based on stream gage records.

The following table presents the results of each procedure, and, for comparison, the discharges adopted for the 1977 Flood Insurance Study.

Table 3. Hydrological Analysis

Flood Frequency (Years)	Estimated Flood Discharge (cfs)				
	1977 FIA Study	PGH-COE Equation	SCS HEC-1 Hydrograph	PSU-IV Procedure	USGS Bulletin 13
100	1300	1880	1600	1180	800

A design discharge of 1,600 cfs, based on the SCS HEC-1 hydrograph, was used as a basis for this study. PSU-IV and Bulletin 13 procedures are based on stream gage data and give generally low estimates on smaller watersheds. The 100-year peak flow of Church Run is 1,300 cfs at the proposed dam site and is 1,600 cfs at the mouth of Church Run.

The computer program entitled "Water Surface Profiles," (HEC-2) developed by the U.S. Army Corps of Engineers, was used to estimate the hydraulic capacity of bridges along Church Run. The results are given in the following table, which include the approximate hydraulic capacities of the bridges in terms of flood frequency and cubic feet per second. As clearly shown by the following table, hydraulic capacity of these bridges is inadequate for even minor flood discharges (Table 4).

Table 4. Approximate Hydraulic Capacity of Bridges

Bridge or Encroachment	Bridge Discharge Capacity With No Backwater (cfs)	Maximum Flood With No Backwater	Bridge Span (feet)
W. Mount Vernon Street	780	10-year	18
Church Run Street	500	5-year	17
Union Street	1120	25-year	21
N. Franklin Street	315	less than 5-year	18
Barn Spanning Stream	320	less than 5-year	30
Linden Place	235	less than 5-year	15
Spruce Street	190	less than 5-year	14
Hemlock Alley	230	less than 5-year	16
Walnut/Martin St. Enclosure*	400	less than 5-year	16
N. Drake Street	305	less than 5-year	13
N. Kerr Street	670	10-year	14
Footbridge	500	5-year	12
E. Main Street	890	10-year	18
E. Central Avenue	1080	25-year	17
Sidewalk Crossing	350	less than 5-year	11
Spring Street	230	less than 5-year	15
Abandoned Railroad Spur	230	less than 5-year	15
Two adjacent RR bridges	230	less than 5-year	14
/Water St. Bridges	Brown 320	less than 5-year	16-19**

*This enclosure includes the culvert under the front yard of a residence.
**This bridge has an inlet width of 16 feet and an outlet width of 19 feet.

3.4.1 Alternative A – No Action Impacts and Consequences

Surface runoff, groundwater, and water quality would not be impacted by the no action alternative.

3.4.2 Alternative B - Detention Dam Impacts and Consequences

In the long term, the detention dam would disrupt the natural flow characteristics of the Church Run Watershed. Floodwater up to and including the 100-year flood, would be controlled and released at a reduced rate. The impoundment area, demarcated by the 100-year flood elevation, is designed to completely drain in less than 24 hours. The flow released from the dam during storm events would be controlled by the size of the outlet structure. The duration of this controlled flow would increase relative to current conditions, however, the peak discharge would be reduced significantly. The 150-foot

section of Church Run where a conduit through the dam is proposed would be changed for the life of the dam.

Construction activities to build the dam and conduit would have a temporary adverse affect on Church Run from suspended sediment. The amounts of suspended sediment would be minimized by implementing strict erosion and sedimentation control during construction and in compliance with the requirements of the NPDES permit program. Following these strict standards and guidelines ensures that water quality impacts to downstream environments are minimized. Both the long-term or short-term adverse affects are minor because neither would significantly alter Church Run's normal flow characteristics.

3.4.3 Alternative C - 100-Year Concrete U-channel Impacts and Consequences

This alternative would impact surface runoff characteristics along the approximately 6,200-foot length of channel by affecting velocity, flow depth, slope, etc. Control structures would reduce the impacts on velocities, flow depths, sediment transport, etc. on downstream environments. Since flood flows would be completely contained within the U-channel, groundwater infiltration would be eliminated through this section of the watershed.

Construction activities would cause suspended sediment to be introduced into Church Run. The amounts of suspended sediment would be minimized by implementing strict erosion and sedimentation control during construction and in compliance with the requirements of the NPDES permit program. Following these strict standards and guidelines ensures that impacts to downstream environments are minimized to the maximum extent practicable.

3.5 Terrestrial and Wetland Vegetation (Executive Order 11990)

Ornamental plants and non-native weeds dominate vegetation throughout the urban area in the City of Titusville. The vegetation in the urban area is actively managed to create yards and other residential landscape features. Natural wetlands have mostly been eliminated from the floodplain within the City limits.

Immediately upstream of the City limits and including the inundation limits from the proposed detention dam, the vegetation is dominated by wetland plants (Appendix B). Most of the dominant species in the wetland complex located upstream of the City limits are indigenous to Pennsylvania. Much of the vegetation adjacent to the wetland complex in the upland areas and adjacent to the proposed detention dam is pasture for livestock or otherwise managed for agricultural crop production. Adjacent upland areas that are not used for agriculture are early successional and regenerating forests.

The wetland complex upstream of the City limits consists of two wetland types that are best described as palustrine emergent wetlands and palustrine scrub/shrub wetlands in accordance with the Cowardin classification system (1979). There are two distinct vegetation communities in the wetland complex. One vegetation community is best described as herbaceous wetlands and the other as palustrine shrublands in accordance

with the classification and community descriptions developed by the Pennsylvania Natural Diversity Inventory (Fike, 1999).

The herbaceous wetlands are categorized as persistent emergent wetlands and can be further classified as wet meadow wetlands (Fike, 1999). Graminoids and sedges dominate the wet meadow (Figure 10). Cattle grazing and mowing during dry periods maintain the herbaceous wetland plant community by arresting the regeneration of woody vegetation. Absent grazing and mowing, the wet meadow would develop into a palustrine shrubland. The grazing and mowing maintenance has promoted the establishment of two non-indigenous and particularly troublesome plant species; Common buttercup (*Ranunculus acris*), and Reed-canary grass (*Phalaris arundinaceae*). Although less prevalent than Common buttercup in this wetland, Reed-canary grass is especially aggressive and may increase in abundance with continued grazing and mowing. Canadian thistle (*Cirsium arvense*) and Bull thistle (*Cirsium vulgare*) were identified in non-wetland areas adjacent to the wet meadow where the vegetation also is dominated by herbaceous plants. These two thistles are listed as Pennsylvania Noxious Weeds and subject to regulation under the Pennsylvania Noxious Weed Control Law.

The palustrine shrublands are categorized as broadleaf palustrine shrublands and can be further classified as alder-ninebark wetlands (Fike, 1999). Alders (*Alnus serrulata* or *A. incana*) are co-dominant shrubs with Ninebark (*Physocarpus opulifolius*) in this wetland complex. The understory dominant vegetation consists of Skunk cabbage (*Symplocarpus foetidus*), Ostrich fern (*Matteuccia struthiopteris*) and Fowl manna-grass (*Glyceria striata*).

All of the wetlands located in the Church Run Watershed meet the definition of Exceptional value wetlands as defined by Chapter 105 of the Commonwealth of Pennsylvania Dam Safety and Encroachments Act (Chapter 105). The wetlands meet this definition because they are located in or along the floodplain of a wild trout stream, Church Run. This category of wetlands deserves special protection in accordance with the Chapter 105 regulations. Executive Order 11990, Wetlands Protection, also requires federal agencies to avoid wetland impacts unless there are no practicable alternatives. FEMA uses the same eight step planning process outlined at 44CFR Part 9 to evaluate project wetland effects. Completion of this EA is consistent with the eight-step process.

3.5.1 Alternative A-No Build Impacts and Consequences

This alternative would not have an impact on vegetation or wetlands.

3.5.2 Alternative B-Detention Dam Impacts and Consequences

Primary and secondary adverse wetland impacts would total 1.91 acres to the wet meadow. The footprint of the dam would occupy approximately 0.5 acres and the remainder of the impact would result from construction disturbance and site re-grading. The inundation during a 100-year storm event is less than 24 hours, and would not have an adverse impact on the wetland. The detention dam is not designed to maintain a permanent pool.

Alternative locations for the dam were investigated to avoid and minimize wetland impacts. Siting the dam upstream of the proposed location would fragment the wetland complex into two smaller wetlands resulting in significant adverse secondary impacts. Additionally, locations upstream of the proposed site would result in inundation of SR 89 and residential properties during the 100-year storm event. The dam cannot be located further downstream of the proposed site because of impacts to private residences and the need for adequate distance to allow flows to re-enter the channel without flooding the residences. The proposed site of the dam would avoid and minimize wetland impacts to the maximum extent practicable.

Property acquisition/permanent easements from individual landowners would be pursued for the 100-year inundation zone upstream of the dam. The management of the inundation zone would change as a result of these transactions so that grazing and mowing would be eliminated. The result of eliminating grazing and mowing in the existing wet meadow would be development of a broadleaf palustrine shrubland and conversion from agriculture to forest landuse. Overall, the change in wetland vegetation would benefit the environmental qualities of the Church Run Watershed. Improvements include, but are not limited to; improved water quality, reduction in non-native plants like Reed-canary grass, Common buttercup, Canada thistle, and Bull thistle because they are not shade tolerant, and increased input of detritus to Church Run that would benefit stream ecology.

Wetland replacement areas are being designed to meet several goals and criteria and to compensate for unavoidable adverse wetland impacts. The ratio of replacement area to impact area is being designed at a minimum of 1.5:1, or approximately 3 acres of replacement wetlands. The replacement wetlands are being designed for non-wetland areas within the 100-year flood inundation limits upstream of the detention dam. Siting the replacement wetlands upstream of the impact location meets the goal of replacing impacted wetlands immediately adjacent to the impact site and within the same watershed. The replacement wetlands would be in the floodplain of Church Run, or its tributaries, and upon re-establishment, would meet the definition of Exceptional value wetlands in accordance with Chapter 105.

3.5.3 Alternative C-100-Year Concrete U-Channel Impacts and Consequences

The Concrete U-Channel alternative would not have a significant impact on terrestrial and wetland vegetation. The existing vegetation that would be impacted by this alternative provides little benefit to the natural environment in the Church Run Watershed. Replacing landscape vegetation that would be impacted during construction is a relatively straightforward undertaking and service that many commercial entities can provide.

3.6 Channel Physical Characteristics and Habitat

Church Run is a perennial flowing, coldwater stream that is primarily spring fed. Riparian corridors in the upper approximately 85% of the watershed are forested and stream channels are mostly shaded. There are no obvious non-point or point sources of pollution in the upper watershed. The streambed is gravel-cobble and large woody debris

is abundant in the upper sections. The channel morphologic characteristics in the upper reaches are typical of C4 stream types as defined by the Rosgen (1994) classification system and appear to be relatively stable without significant channel erosion. In-stream habitat characteristics are ideal for species typical of cold-water streams.

The lower sections of the channel are best described as urban in nature with many characteristic anthropogenic modifications. Non-point sources of pollution are substantial in the lower sections due to the urban nature of the riparian area and the stream is mostly un-shaded. The morphologic characteristics of the channel are analogous to Rosgen's F stream types through the urban areas. Flow characteristics are altered, riffle and pool complexes are compromised, streambanks are unnatural, and the general environmental qualities are below average to poor throughout the lower sections of Church Run in the City of Titusville.

The streambanks throughout the urban areas of the City of Titusville consist of concrete or masonry walls. At several locations along the channel there are houses built on top of the walls or house foundations serve as the stream wall. The existing channel walls, for the most part, are in poor condition due to deterioration and undermining. Some sections of the walls have collapsed. In March 1989 a section of wall collapsed along the west bank upstream of Spruce Street. On two other reaches, channel walls, undermined by erosion and leaning, are braced by heavy steel pipes which span the top of the channel. As a result of the July 15, 1990 flood, more channel walls collapsed throughout the Church Run channel leaving many of the streambanks unprotected against future erosive floodwaters.

3.6.1 Alternative A-No Build Impacts and Consequences

This alternative would not have an impact on the channel characteristics or habitat.

3.6.2 Alternative B-Detention Dam Impacts and Consequences

The proposed detention dam would require construction of a 150-foot conduit to convey water through the detention dam, which would have an adverse impact on stream physical and habitat characteristics. The dam would require a single conduit for normal and flood flow discharges through the structure. This conduit would eliminate natural stream characteristics for an approximately 150-foot channel length. Morphologic adjustments both upstream and downstream of the proposed structure are likely as a result of channel modifications for the proposed detention dam. The specific extent and magnitude of the likely channel adjustments are difficult to predict without significant study and additional data collection. Given the existing and proposed landuse immediately upstream of the proposed detention dam, it is likely that the channel adjustments would progress towards a natural and stable stream condition over time. Accordingly, adverse impacts from this alternative would not be significant in the long-term.

3.6.3 Alternative C-100-Year Concrete U-Channel Impacts and Consequences

The Concrete U-Channel would have a significant adverse impact on in-stream physical and habitat characteristics. The length of channel that would be impacted is significant.

The modifications would result in total elimination of innate substrates necessary for the maintenance of stream ecology through 6,200 lineal feet of channel. In particular, the streambed would be replaced with concrete and few species would survive this modification. Those flora and fauna that would become established after project construction would not represent the level of diversity indigenous to CWF streams and the Church Run Watershed due to habitat losses.

3.7 Fish, Wildlife and Recreational Resources

Wild Brook trout (*Salvelinus fontinalis*), Blacknose dace (*Rhinichthys atratulus*), and Mottled sculpin (*Cottus bairdi*) comprise the major fish species in the upper, non-urban, portion of the Church Run Watershed (PA Fish and Boat Commission, 2005; Cooper et al. 1972; Dunn Geosciences Corporation, 1974; 1977). The presence of reproducing Brook trout is an indication that water quality, habitat, and stream ecology are excellent and supporting the CWF designation. Blacknose dace and Mottled sculpin are dominant in the urban sections of Church Run. The absence of Brook trout as a dominant species in the lower sections of Church Run is an indication that water quality, habitat, stream ecology, or all of the above, are degraded through the urban sections. Table 5 identifies those fish species known to occur in the Church Run Watershed (PA Fish and Boat Commission, 2005; Cooper et al. 1972; Dunn Geosciences Corporation, 1974; 1977)

Table 5. Church Run Fish Species List

Common Name	Species
Blacknose dace	*Rhinichthys atatulus*
Brook trout	*Salvelinus fontinalis*
Creek chub	*Semotilus corporalis*
Fantail or Banded darter	*Etheostoma zonale*
Greenside darter	*Etheostoma blennioides*
Longnose dace	*Rhinichthys cataractae*
Mottled sculpin	*Cottus bairdi*
White sucker	*Catostomus commersoni*

Macroinvertebrate populations in Church Run are diverse and indicate water quality is good in the upper sections of the watershed (Dunn Geosciences Corporation, 1974; 1977). Poorer water quality in the lower, urban sections of Church Run was evident during analysis of the macroinvertebrate species. A shift in dominant species composition and diversity from upstream to downstream locations provided evidence of diminishing water quality, habitat, and morphologic conditions and confirmed the trends discussed in previous sections.

Amphibian, reptile, bird and mammal species are varied due to a variety of habitat types on this region (Dunn Geosciences Corporation, 1974). The upper watershed forested and agriculture landuses support significant populations of white-tailed deer, turkey, squirrel, mourning dove, raccoon, opossum, fox and other game or furbearer species. There is a high recreational and food value resulting from the presence of these species in the Church Run Watershed.

3.7.1 Alternative A-No Build Impacts and Consequences

This alternative would not have an impact on fish, wildlife or recreational resources.

3.7.2 Alternative B-Detention Dam Impacts and Consequences

The proposed detention dam would have an adverse impact on fishes and macroinvertebrates along an approximately 150-foot length of Church Run by eliminating stream habitat and replacing it with a concrete conduit. Fish migration between upstream and downstream sections of Church Run would be adversely impacted if unmitigated. Impacts to fish migration will be minimized by designing a structure that permits the passage of fish species. Temporary impacts to fish downstream of the detention dam would occur during construction. These temporary impacts would be minimized with measures to prevent silt and sediment from entering the channel. The measures would be consistent with the requirements of the National Pollution Discharge Elimination System (NPDES) permit program. In an effort to minimize impact on spawning wild brook trout in Church Run, site work would be restricted between October 1 and December 31. The temporary adverse impacts to fish during construction would not be significant.

The proposed detention dam would displace wildlife species and have an adverse impact on this resource. The impacts would occur during construction and be temporary in nature. Following construction and successful establishment of wetland replacement areas, wildlife species will re-colonize the areas of disturbance. These temporary adverse impacts are not significant.

3.7.3 Alternative C-100-Year Concrete U-Channel Impacts and Consequences

This alternative may be considered a significant adverse impact on fish species because it would further degrade an already impaired an approximately 6,200 foot length of the lower reach of Church Run. The Concrete U-Channel would permanently alter the stream habitat, flow regime and geomorphic characteristics to such a degree that suitable fish habitat would be completely absent or severely degraded. The migration of fish through the Concrete U-Channel would be extremely difficult and unlikely. During low flow periods, a uniform water depth within the channel would eliminate pools, riffles and other stream features essential to maintaining fish populations. There would be no significant impacts to wildlife.

3.8 Threatened and Endangered Species

Federal and Commonwealth listed threatened and endangered species screening to identify potential conflicts was conducted using the Pennsylvania Natural Diversity Inventory (PNDI) database. The PNDI database contains information regarding Federally listed, proposed and candidate species under the federal Endangered Species Act; Pennsylvania listed birds and mammals under Title 34 Chapter 133, Game and Wildlife Code, revised Dec. 1, 1990; Pennsylvania listed fish, reptiles, amphibians and aquatic organisms under Title 30, Chapter 75, Fish and Boat Code, revised February 9, 1991; Pennsylvania listed plants, natural communities, terrestrial invertebrates and geological features under Title 17 Chapter 45, Conservation of Native Wild Plants,

January 1, 1988. The United States Fish and Wildlife Service (USFWS) has jurisdiction over the protection of Federally listed, proposed and candidate species in the database. The Pennsylvania Game Commission, the Pennsylvania Fish and Boat Commission, and the Pennsylvania Department of Conservation and Natural Resources have jurisdiction over protection of the Commonwealth listed resources in the database.

3.8.1 Alternative A-No Build Impacts and Consequences

This alternative would not have an impact on threatened or endangered species.

3.8.2 Alternative B-Detention Dam Impacts and Consequences

The PNDI database was searched in May 2004 for potential conflicts in the location of the proposed detention dam (Appendix C). No Federally listed species under the USFWS's jurisdiction were identified at the location of the proposed detention dam during this search. Two potential conflicts with Pennsylvania listed species were identified in the location of the proposed detention dam during this search. The PNDI search results indicated a potential conflict with; Pink milkwort (*Polygala incarnata*), a plant species under DCNR's jurisdiction; an unidentified species under PAFBC's jurisdiction. Both Commonwealth agencies confirmed that subsurface investigations at location of the proposed detention dam site would not have an impact on the species identified during this search of the PNDI database (Appendix C).

An updated search of the PNDI database for the proposed construction of a detention dam was conducted in June 2005. No Federally listed species under the USFWS's jurisdiction were identified at the location of the proposed detention dam during this search.

The PAFBC reviewed the potential impact from constructing Alternative B- Detention Dam. The PAFBC determined in August 2005 that there would be no adverse impacts pursuant to rare, candidate, threatened, or endangered species under their jurisdiction (Appendix C). Coordination related to the above PDNI results with DCNR and PAFAB indicated that there would be no adverse impacts. Consequently, this alternative would not have an impact on threatened or endangered species.

3.8.3 Alternative C-100-Year Concrete U-Channel Impacts and Consequences

No Federally or State listed threatened or endangered species are known to occur within the City of Titusville where Alternative C was considered (Appendix C). Accordingly, this alternative would not have an impact on threatened or endangered species.

3.9 Environmental Justice Areas (EJA's)

A search of information in the Pennsylvania Department Environmental Protection's Geospatial Network revealed that there are no EJA's within the City of Titusville or the Church Run Watershed. The Department utilized information from the U.S. Census Bureau that was published in the year 2003 to develop the spatial dataset. The dataset defines an EJA as a census tract that has 20% or more of the population in poverty or where 30% or more of the population is non-white. The proposed project would not impact EJA's.

3.10 Cultural Resources

The Pennsylvania Historical and Museum Commission's (PHMC) Cultural Resources Geographical Information System was examined for detailed information on historic and archaeological resources. There are six historic sites listed for the City of Titusville. They are the Titusville Historic District, the John Adam Dower House at 320 W. Spruce Street, the Titusville Junior-Senior High School at 302 East Walnut Street, Titusville City Hall at 107 North Franklin Street, the Titusville Post Office at 135 West Spring Street, and the Algunix Building at 144 West Spring Street. The *National Register of Historic Places* Inventory – Nomination Forms were obtained for the Titusville Historic District and for Titusville City Hall, and are included in Appendix C.

The vast Titusville Historic District occupies an area of 170 acres within the city limits of Titusville. The district contains 503 structures of which 472 are contributing and 31 are intrusive. The district is a compact representation of 19th century architectural styles. The city's greatest growth period coincided with the oil boom of the 1860's.

The preferred action including the dam, water storage area, and replacement wetlands (3 acres), is entirely in Oil Creek Township. No structures will be impacted by the project in Oil Creek Township. All of the historic structures in the Titusville Historic District are located in the City of Titusville.

The Pennsylvania Historical and Museum Commission (PHMC) was asked to comment regarding the potential impacts on both historic and archaeological resources that may occur as a result of constructing Alternative B-Detention Dam with replacement wetlands. The review was conducted under authority of the Environmental Rights amendment, Article 1, Section 27 of the Pennsylvania Constitution and the Pennsylvania History Code and a response letter dated June 9, 2005 documented the findings. The coordination with PHMC also was undertaken to fulfill FEMA's responsibilities under Section 106 of the National Historic Preservation Act, as amended, and implemented by 36 Code of Federal Regulations Part 800. On August 17, 2005, the PHMC was asked for an additional review as the project scope was expanded to include ground disturbance associated with constructing approximately 3 acres of replacement wetlands. Copies of the transmittals are included in Appendix C.
The first review by the PHMC evaluated potential impacts in and around the proposed RCC dam. Earth disturbance associated with the construction of the dam will be approximately 1.5 acres. The second PHMC review included the potential impacts associated with construction of replacement wetlands. The earth disturbance associated with the construction of the replacement wetlands will be approximately 3.0 acres, bringing the total disturbed area for the project to 4.5 acres.

The PHMC completed their second review on August 17, 2005. The PHMC concluded that while there is a high probability that prehistoric and historic archaeological resources are located in the project area, the construction of the dam and replacement wetlands should not have an effect on such resources. Additionally, the PHMC stated that an evaluation of historic structures would not be necessary.

3.10.1 Alternative A – No Action Alternative Impacts and Consequences

The no action alternative would allow the past flood problems experienced along Church Run to continue. The hydraulic capacities of the bridges over Church Run are inadequate for even minor flood discharges. Church Run would continue to have minor flood discharges diverted southward along Franklin and Martin Streets, thus inundating low areas of the Titusville Historic District located along Franklin, Martin, Walnut, Main, Central, and Spring Streets.

Flooding would also continue in the 100-year flood plain of Church Run. Residents, businesses, and numerous structures of the Titusville Historic District along Union, Spruce, Hemlock, Walnut, Main, Central, Spring, Franklin, Martin, Drake, Kerr, and Brown Streets, and along Linden and Cherry Place would continue to be flooded. A total of 159 contributing structures of the Titusville Historic District would continue to be flooded by storms of less than a 5-year frequency.

3.10.2 Alternative B-Detention Dam Impacts and Consequences

The dry dam would detain floodwaters up to and including the 100-year flood and release them at a reduced rate. This would allow Church Run to pass under the bridges and culverts through the Titusville Historic District without exceeding their flow capacity. Accordingly, historic properties that contribute to the District would benefit from this alternative by being less vulnerable to repetitive and damaging floods.

3.10.3 Alternative C-100-Year Concrete U-channel Impacts and Consequences

Alternative C is a concrete U-channel having a hydraulic capacity to accommodate the 100-year design flood of 1,600 cfs. The U-channel dimensions would be a bottom width of 17 feet and walls 5 to 6 feet high and a length of 6,200 feet. The U-channel would eliminate the overbank flows that produce a large inundation area in the residential and business district of Titusville and remove numerous homes from the 100-year floodplain of Church Run in the City of Titusville.

Twenty-one existing bridges would have to be removed for this project and new bridge decks across the U-channel would be required. The new concrete channel walls would be used as abutments with Titusville being responsible for replacing the bridge decks. Realigning the channel would be required at Franklin Street, Martin-Walnut Street, and Brown-Water Street. In order to maintain the required width of the channel, historic homes that contribute to the District along Drake Street, and up to 8 historic homes along Martin Street would have to be removed. The potential detrimental impact to 12 historic structures listed in the Titusville Historic District necessitated that other options of providing flood control be considered.

3.11 Socioeconomics

Areas that are affected by flooding of Church Run in the City of Titusville are within a Keystone Opportunity Zone (KOZ). The KOZ is a program through the Pennsylvania Department of Community and Economic Development that advances a community's abandoned, unused, or underutilized land and buildings into business districts and

residential areas. A goal of the KOZ is to develop a well-rounded and well-balanced approach to community revitalization. All KOZ's are virtually tax-free.

3.11.1 Alternative A-No Build Impacts and Consequences

The no build alternative could have an adverse impact on that portion of the KOZ that is in the floodplain. Maintaining the status quo would leave those businesses and residents vulnerable to flood damage and potentially limit their ability to develop per the KOZ's objectives.

3.11.2 Alternative B-Detention Dam Impacts and Consequences

This alternative would provide significant benefit to the KOZ in the City of Titusville. Businesses and residences that otherwise would avoid locations subject to repeated flood damages may have an interest in areas where flood damages would be eliminated. Abandoned, unused or underutilized land and buildings within the flood damage areas and the KOZ would be more likely to support business or residential development.

3.11.3 Alternative C-100-Year Concrete U-Channel Impacts and Consequences

This alternative would provide significant benefit to the KOZ in the City of Titusville. Businesses and residences that otherwise would avoid locations subject to repeated flood damages may have an interest in areas where flood damages would be eliminated. Abandoned, unused or underutilized land and buildings within the flood damage areas and the KOZ would be more likely to support business or residential development.

4.0 PERMITS, CONSULTATIONS AND COORDINATION

Staff members from the Pennsylvania Department of Environmental Protection, Bureau of Waterways Engineering met with Regulatory Agency representatives at the monthly Environmental Review Committee (ERC) meeting on June 28, 2005 to discuss the proposed flood protection project. Meeting minutes from the ERC are presented in Appendix C. Coordination with PHMC is complete and documented in Appendix C. Federal and State agencies charged with protecting threatened and endangered species have been consulted through a search of the PNDI database. Potential conflicts with the State listed resources identified during a search of the PNDI database have been resolved and a determination of no impact was completed (Appendix C).

Additional consultation and coordination beyond the ERC is ongoing with the United States Army Corps of Engineers pursuant to Section 404 of the Clean Water Act; PADEP pursuant to Chapter 105 of the Dam Safety and Encroachment Act, Section 401 of the Clean Water Act, and NPDES permitting. Coordination will also be done with the Crawford County NFIP Coordinator in view of completing appropriate floodplain ordinance permitting, possibly including a Conditional Letter of Map Revision followed by filing a Letter of Map Revision.

5.0 PUBLIC PARTICIPATION

Alternatives to resolving the downtown flooding have been discussed at locally sponsored public meetings and published in local media outlets. For FEMA, consistent

with the NEPA and EO11988, the objective of the public participation process is to provide parties interested in or affected by the proposed project the opportunity to comment on the draft EA. A notice of intent to prepare this Environmental Assessment was published in the Titusville Herald on July 29, 2005 (see Appendix D). During the course of the 15-day comment period, no public comments were received. A public notice will be published in the Herald indicating the draft EA and draft Finding of No Significant Impact (FONSI) is available for public comment. The public comment period will be 15 days and the documents will also concurrently be sent to pertinent regulatory agencies for review. The draft EA and FONSI will be made available at the Titusville public library and posted on FEMA's website http://www.fema.gov/ehp.shtm. Substantive comments will be taken into consideration in the grant approval process.

6.0 MITIGATION MEASURES

Although no potentially significant adverse environmental effects have been identified, the following mitigation measures would be required or recommended for the preferred action to reduce identified adverse environmental effects:

1. All project local, Commonwealth, and Federal permitting shall be obtain before construction; and terms complied with during site work. Specific permitting includes, DEP NPDES permit, Water Quality Certification, and Chapter 105 dam permitting; and USACE Section 404 permit.
2. Short-term adverse affects to on-site and nearby air quality from fugitive dust caused by site preparation (vegetation removal, clearing and grading) can be reduced by periodically wetting the construction area.
3. Unavoidable wetland impacts will be compensated with 3 acres of wetlands restoration.
4. Access to unsafe areas or heavy equipment during the construction period should be restricted, and signage posted to warn of potential unsafe conditions.
5. Although no historic properties were identified at the site, in accordance with the NHPA, should unanticipated historic or cultural materials be found during construction, all construction activities shall cease immediately within 100 feet of the remains until their cultural affiliation and ultimate disposition are determined in consultation with the PHMC, and other interested parties.
6. Although there is no information to suggest presence of hazardous materials at the site, if these are encountered during construction; all hazardous materials shall be either abated, remediated or disposed of as appropriate, and otherwise handled in accordance with applicable local, state, and federal regulations.

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