Section 2
Problems and Goals for the Nine Mile Run Watershed

The impacts of urbanization within the Nine Mile Run (NMR) watershed have altered natural drainage patterns, altered natural rainfall-runoff-storage relationships, and added pollutants to storm water runoff and watershed streams. These urban impacts have resulted in a decline in the quantity and quality of aquatic and riparian habitat and limited opportunities for the public to enjoy the many benefits that water provides to the NMR watershed.

Public meetings were conducted with residents and stakeholders within the NMR watershed to identify and prioritize watershed problems and goals. A series of field investigations and assessments were conducted along NMR and Fern Hollow to obtain new data, quantify the impacts and problems of urban pollution, and identify opportunities for remediation. An extensive assessment of channel morphology and stream stability was conducted to identify and locate problem areas and assess alternative ways to mitigate accelerated bed and bank adjustments. Modeling activities were conducted to characterize and simulate the impacts of urbanization on hydrologic and hydraulic processes in the NMR watershed and provide a design tool for remediation measures. As a result of these completed activities and tasks, a series of problem statements were developed for the NMR watershed. These identified problems are documented in Sections 2.1 through 2.6 below. Section 2.7 documents the resulting watershed planning goals and objectives that were developed.

2.1 Flow Along Watershed Streams

Urbanization within the NMR watershed has resulted in significant changes to rainfall-runoff-storage relationships and negative impacts to watershed flow during both dry and wet weather periods. During the watershed planning process, the following problems were identified with regard to flow along watershed streams.

- **Diminished Dry Weather Flow:** Base flow along watershed streams is minimal during extended periods of dry weather. Urbanization within the watershed has resulted in the loss of wetlands and surface depression storage that formerly acted as watershed sponges. Urbanization has also resulted in a loss of connectivity between stream channels and their adjacent floodplains.

- **Increased Storm Flow:** Storm flows along watershed streams have increased significantly. Increases in impervious area associated with urbanization have resulted in increased runoff volumes and peak flows during storms.

- **Commingling of Storm water runoff and Wastewater:** Storm water runoff, a watershed asset, is captured by combined sewers and commingled with sanitary wastewater, and discharged into watershed streams as combined sewer overflows.

2.2 Erosion Along Watershed Streams

Urbanization within the NMR watershed has degraded the natural morphology of streams. Field inspections conducted as part of the watershed planning process identified the following problems regarding erosion along NMR watershed streams.

- **Incised Stream Channels:** Increased storm runoff volumes and flow velocities have deepened stream channels, severing natural connections between channels and their respective flood plains.

- **Straightened Channel Alignments:** Increased urban runoff and associated erosion have resulted in the loss of natural channel meanders, increased channel slopes, and increased stream velocities.

- **Lateral Scouring:** Channel erosion caused by increased urban runoff has made channel banks unstable and natural width to depth ratios have been degraded.

- **Bed Loads:** Accelerated erosion along urban watershed streams has significantly increased bed-load volumes of gravel, sand, and grit. These bed loads and bars are unstable and potentially destructive to aquatic habitat.

- **New Point Discharges:** New storm drainage system outfalls associated with the Summerset Development project do not have adequate velocity dissipation controls and increase channel erosion and bank instability.

2.3 Water Quality Along Watershed Streams

Urbanization within the NMR watershed has introduced water quality constituents that may affect in-stream water quality. Field investigations, sampling, and laboratory analyses conducted during the early phases of the watershed planning process identified the following water quality problems during dry and wet weather conditions.

- **Wastewater Discharges During Dry Weather:** In dry weather, illicit wastewater connections [1] and discharges and sewer system exfiltration are responsible for a significant amount of raw sewage to enter watershed streams, resulting in elevated bacteria concentrations, BOD levels, and ammonia concentrations.

- **Alkaline Leachate from the Slag Disposal Area:** Approximately 17 million tons of steel mill slag has been piled over an area of 238 acres in the lower reaches of the NMR watershed. Leachate from the slag into the NMR stream channel has a very high pH that exerts a strong influence on in-stream pH during dry weather. These observed pH influences significantly degrade aquatic habitat quality.

[1] Illicit wastewater connections are non-storm water discharges to a storm water collection system that may include industrial process water, cooling water, wash water, and sanitary wastewater among others.

- **Temporary Dissolved Oxygen Sags:** Moderate oxygen depressions were sometimes observed along watershed streams for short durations. These lower range concentrations occurred during low flow periods and were attributed to communities of algae that generate oxygen by day and consume oxygen at night.

- **Wet Weather CSO and SSO Discharges:** During wet weather, combined sewer overflows (CSOs) and sanitary sewer overflows (SSOs) discharge a mixture of storm water and sewage into watershed streams. These point discharges contribute fecal bacteria, biochemical oxygen demand, phosphorus, nitrogen, and other nutrients to streams.

- **Non-Point Discharges During Wet Weather:** During storms heavy metals, deicing salts, and other water quality constituents are washed into streams from highways, and nutrients are washed from lawns in the urbanized portions of the watershed. Animal wastes from unleashed dog running contribute bacteria to streams.

- **Increased Stream Temperature in Wet Weather:** When rain hits hot urban streets in the watershed, the resulting storm water runoff can warm receiving streams by several degrees.

- **Floatable Materials from CSOs, SSOs, and Urban Runoff:** Floatable materials such as styrofoam cups and plastic bags; trash and debris from careless dumping; and other urban solid wastes catch on rocks and tree branches and degrade the aesthetic and habitat quality of watershed streams.

2.4 Urban Impacts on Watershed Vegetation

Urbanization within the NMR watershed has imposed negative impacts on the biodiversity of plant species. The watershed planning process included field investigations that were conducted of riparian vegetation within the watershed. The following problems with regard to watershed vegetation were identified.

- **Invasion of Exotic Species:** Aggressive, invasive exotic plant species (e.g. Japanese Knotweed, Tree-of-Heaven, Bush Honeysuckles, and others) have colonized disturbed areas, out competing native species while offering lower ecological value. Many of these ornamental exotics from urbanized residential and park areas have become the dominant species of the riparian zone.

- **Lack of Wetland Vegetation:** Wetland areas and vegetation purify water, mitigate storm flows, provide low flow augmentation, and provide quality habitat. Urbanization has destroyed much of the natural wetland areas within the NMR watershed.

- **Lack of Streamside Vegetation:** Healthy shoreline vegetation is an integral part of watershed management because it stabilizes stream banks, provides cooling shade, and provides critical habitat and cover. Urbanization has contributed to extreme

hydrologic and hydraulic conditions that have disturbed shoreline vegetative communities.

- **Lack of Vegetative Cover on Slag Pile Slopes:** The slopes of the slag disposal piles are mostly devoid of vegetative cover and are located in the immediate vicinity to the NMR stream channel. The bare slopes are aesthetically unpleasing, and do not provide cooling shade or riparian habitat cover for the channel.

2.5 Urban Impacts on Aquatic and Riparian Habitat

The impacts of urbanization within the NMR watershed can significantly stress and limit available aquatic and riparian habitat. As part of the watershed planning process, field investigations and analyses were conducted to characterize habitat quantity and quality. The following habitat area problems were identified.

- **Urban Impacts on Stream Quantity and Quality:** The diversity and quantity of aquatic and riparian animal species is limited due to minimal base flow along streams and adverse urban water quality constituents.

- **Discharges of Slag Leachate to the Stream:** Leachate seeps out of the slag pile hillside adjacent to NMR and out of a storm drainage pipe and flows directly into the stream. These high pH discharges significantly increase the pH of the base flow in the stream during dry weather. Aquatic habitat quality is adversely impacted.

- **Urbanization Barriers to Fish Migration:** Sewer pipes are encased in concrete where they cross or run along stream channels. Sewer crossings often act as concrete dams across urban streams and act as a barrier, preventing fish from being able to migrate freely along the stream in search for food and shelter.

- **Impacts of Mowing Stream Channel Banks:** Many of the remaining unculvertized stream channels within the NMR watershed are located along urban parks. Natural vegetative cover along streams has been replaced with mowed grass, significantly degrading riparian habitat quality.

2.6 Impacts of Watershed Recreation

Urban recreation can sometimes produce negative environmental impacts to the watershed. The watershed planning process identified the following problems:

- **Location of Existing Athletic Fields:** Existing soccer and baseball fields are located within the footprint of where the fluvial geomorphologically corrected NMR stream channel and floodplain wetland should be. Field conditions are often wet, soggy, and unacceptable for athletic use. Opportunities for expanded wetland and riparian habitat areas are minimized unless the athletic fields are relocated.

- **Improper Dog Run Activities:** Unleashed dog run activity is intense within Frick Park, and can result in significant damage to delicate aquatic and riparian habitat areas. Failure by dog owners to obey dog waste collection ordinances results in elevated fecal bacterial levels in watershed streams and open recreation fields spoiled by dog waste.

- **Competition Between Watershed Recreation and Habitat:** Active recreation and riparian habitat tend to be mutually exclusive land uses - the mowed grass associated with athletic fields makes a poor riparian habitat. There are strong urban pressures to maximize active recreation within the NMR watershed. There is also a significant need to expand wetlands and riparian habitat. The watershed planning process will need to determine an optimal balance between the competing land uses.

2.7 Watershed Planning Goals and Objectives

Completed historical research, field investigations, and data analyses have confirmed that the impacts of urbanization within the NMR watershed have resulted in a significant decline along remaining riparian corridors. However, the NMR watershed offers opportunities for real improvement in water quality, channel stability, hydrologic regimes, biodiversity, and habitat quality through the use of stream restoration, urban retrofit, and other restoration techniques. The finalized NMR watershed management plan will define how and where management and restoration tools specifically are applied to capitalize on these water resource opportunities.

The information gathered from the completed historical research, field investigations, and data analyses were used to determine a series of appropriate and achievable planning goals and objectives for the NMR watershed. For clarity, these planning goals and objectives were grouped into the following four categories.

- Stream stability and water quality

- Rainfall-runoff relationships

- Aesthetic quality

- Recreation opportunities along riparian corridors

Goal #1, Stream Stability and Water Quality: Manage the NMR watershed in a way that treats streams as a valuable watershed resource. Maximize the quality of the remaining open streams in the watershed by improving the stability and natural configuration of stream channels and floodplain over-banks, improving water quality during dry and wet weather, and improving the quantity and quality of aquatic habitat.

- Use green engineering techniques to mitigate existing channel and channel bank erosion, to arm and stabilize stream channels to protect them from scour and prevent erosion in the future, and to minimize associated bed load volumes of gravel, sand, and grit.

- Use sound geomorphological principals [2] to restore natural channel sizes and proportions (depth to width ratios), restore natural meandering channel configurations and invert slopes, and restore the natural connectivity between stream channels and adjacent floodplains.

- Remove illicit wastewater discharges, disconnect illicit sanitary connections to storm drain systems, and rehabilitate wastewater collection systems to stop sewer exfiltration and significant amounts of raw sewage from entering watershed streams.

- Remove discharges of high pH slag pile leachate into the lower reaches of Nine Mile Run during dry weather periods.

- Encourage watershed municipalities and public work departments to implement rehabilitation and control measures necessary to eliminate sanitary sewer overflow (SSO) discharges and reduce combined sewer overflow (CSO) discharges to watershed streams.

- Encourage watershed municipalities, businesses, and residents to mitigate non-point discharges from urbanized areas that contribute water quality constituents that degrade watershed streams.

- Develop and implement a comprehensive public education plan to make watershed residents and businesses aware that certain behaviors may be linked to water quality problems, to encourage them to change these behaviors, and to educate them on how to live responsibly within their watershed and practice a good watershed ethic.

Goal #2, Rainfall-Runoff Relationships: Manage the NMR watershed in a way that treats rainfall and storm water runoff as valuable watershed assets. Mitigate negative impacts of urbanization on rainfall-runoff relationships in the watershed and stream flow during dry and wet weather.

- Increase base flow along watershed streams by creating new wetland areas that act as watershed sponges to trap and store rainfall and storm water runoff and release it slowly over time to augment dry weather flow.

[2] Fluvial geomorphology is the science that assesses the shape, form, and dynamics of a watercourse and the contributing physical processes, including the conveyance of water as well as the supply and movement of sediment.

- Encourage restorative redevelopment within the watershed to disconnect storm drainage from combined and sanitary sewers and reconnect it with vegetation and soil, using available natural processes to do the work of storm water storage and treatment. Selectively remove existing superfluous impervious areas in the watershed or convert them to pervious or semi-pervious areas.

- Encourage the construction of new storm water detention and retention areas and facilities throughout the watershed to intercept and store runoff, decreasing runoff volumes and peak discharge rates along streams.

- Encourage the Pittsburgh Water and Sewer Authority (PWSA) to identify and implement opportunities to disconnect individual catch basins from the combined sewer system and redirect the runoff to surface streams so that storm water is not commingled with wastewater and CSO discharges in the watershed are reduced.

- Develop and implement a comprehensive education plan for municipal zoning officers, planning commission members, businesses and residents to make them aware of the concept of restorative redevelopment, to encourage them to identify opportunities to reduce existing impervious surfaces and reconnect storm runoff to vegetation and soil, and show them how to implement these measures.

Goal #3, Aesthetic Quality: Manage the NMR watershed in a way that recognizes the aesthetic and habitat value of natural greenways along riparian corridors. Maximize the aesthetic quality of riparian corridors along the watershed and maximize the quantity and quality of riparian habitat.

- Develop and implement structural and non-structural controls to prevent floatable materials, trash and debris from entering watershed streams, catching on rocks and tree branches, and degrading the aesthetic quality of riparian corridors.

- Encourage the development of volunteer groups to plan and implement litter control and cleanup activities to provide needed labor resources and to maintain the involvement needed to keep the riparian corridor clean and attractive.

- Develop and implement a comprehensive public education plan to make watershed residents and businesses aware of the impacts of urban street litter to aesthetic problems along streams, to educate the public about litter reduction, to encourage litterers to change these behaviors, and to educate them on how to live responsibly within their watershed and practice a good watershed ethic.

- Enhance riparian vegetation and create vegetative buffer zones along stream channels and adjacent floodplain areas by replacing mowed lawns and disturbed shore-lines with a diverse range of native species that stabilize stream banks, provide cooling shade, and provide habitat cover.

- Develop and implement an ongoing watershed program along riparian corridors to control aggressive and invasive plant species that have replaced the natural dominant species of higher ecological value.

- Develop and implement a cooperative program to revegetate the slopes of the slag disposal piles.

Goal #4, Recreation Opportunities: Manage the NMR watershed in a way that recognizes the recreational opportunities along riparian corridors and natural greenways. Maximize active and passive recreational opportunities along streams and floodplains while maintaining habitat quality.

- Relocate existing athletic fields and playgrounds out of critical riparian corridors in order to maximize opportunities to implement fluvial geomorphological corrections to stream channel configurations, expand wetland areas, and increase riparian habitat. This would have the additional benefit of well drained playing fields.

- Establish a system of recreational trails that link Frick Park, the Monongahela River trail, and adjacent residential communities; provide public recreational access to the riparian greenway corridor and streams; provide maintenance access to sustain the riparian corridor and associated facilities; and enhance recreational opportunities within the watershed.

- Develop and implement an aggressive public education program about the proper collection and disposal of pet wastes to encourage residents to clean up after pets so that dog run recreation does produce bacterial contamination or degrade the aesthetic and recreational quality of parklands. Provide and maintain trash recepticals.

- Expand aquatic and riparian habitat areas and improve habitat quality to maximize the diversity of natural wildlife along riparian greenway corridors to promote fishing, bird watching, and other recreational activities with wildlife.

- Develop and implement a public awareness program regarding recreational opportunities within the NMR watershed to maximize the use of trails, playgrounds, parks, and athletic fields by the public and ensure continuing maintenance and sustainability.