IV. Water Resources

IV-a. Tributaries (Map I-d)

The NMR watershed drains the southeastern part of Pittsburgh and portions of the three neighboring boroughs of Swissvale, Edgewood, and Wilkinsburg. The main branch of NMR is above ground within Pittsburgh, extending from its mouth at the Monongahela River up through the south end of Pittsburgh's Frick Park. Upstream and to the east of Frick Park (east of Braddock Avenue) NMR is completely underground in a concrete culvert, with several culverted tributaries connected underground.

The largest tributary to NMR is Fern Hollow Creek. This brook runs from north to south through Frick Park to meet NMR. Fern Hollow Creek contributes flow most of the year with the exception of some occasions during dry summer weeks.

The remaining tributaries in the NMR watershed have been culverted and are no longer in their natural state. However, they are significant because they contribute a majority of the flow to NMR. The main branch of NMR lies in a culvert, often called the Wilkinsburg Culvert, that runs from north to south through Wilkinsburg and Edgewood. There are several culverted branches within Wilkinsburg that contribute flow, presumably from groundwater or natural springs. These culverts also act as storm sewers during wet weather.

Adjacent to the mouth of the Wilkinsburg Culvert are two storm sewers which also contribute flow year round. These storm sewers can be traced on maps in the direction of tributaries that existed before extensive development occurred in this area. One extends up the valley alongside and beneath I-376 in Edgewood, and the other beneath an Edgewood shopping center and into Swissvale. During the 1997 summer months, these "storm sewers" contributed more flow than the main branch of NMR, likely from the same sources. These influents can safely be labeled as tributaries, although there is no historical name associated with them.

IV-a1. Other Tributaries

Another similar tributary/storm sewer originating from the west end of Swissvale flows into NMR upstream of Frick Park. As a tributary in dry weather, it contributes consistent though very little flow to NMR. Downstream of Frick Park, a concrete pipe originating in the direction of an original NMR tributary valley has a consistent flow of water to NMR. This pipe is not a storm sewer and is likely groundwater that has been piped directly to the stream. A former tributary that is now covered by slag in the lower reaches of the stream still contributes flow to NMR. This flow enters NMR as seepage along the banks of the stream and is very significant in dry months when flow in the stream is low.

A major tributary meets Nine Mile Run just upstream of its mouth at the Monongahela (at Duck Hollow). This tributary has also been culverted, though it contributes significant flow to NMR.

Community Input

Bob Hurley mentioned that the mouth of NMR at the Monongahela River makes the site unique. There are few opportunities in the urban region where a stream flows into a larger river in daylight.

IV-b. Wetlands

Wetlands are important ecosystems that contribute greatly to their **bioregional** contexts and serve vital **hydrological, biogeochemical**, and habitat functions. These, in turn, provide important societal values, including flood control, maintenance of biodiversity, enhancement of water quality, and aesthetic, recreational, and educational opportunities (Cole and Tamminga, 1997).

Large, high-energy **riverine** and floodplain wetlands were likely to have been found along the Monongahela, Allegheny, and Ohio Rivers prior to the obliterating effects of bank stabilization, flood control works, and industrialization of shorelines and floodplains. NMR, in its own comparatively diminutive way, has gone through a parallel process of urban industrialization and wetland displacement.[1] Historic aerial photographs and geological mapping show an extensive floodplain in the lower reaches of NMR, now largely covered with slag and landfill. Lowland forest growth would historically have covered much of this area. Because of the relatively steep gradient of NMR as a headwater (first and second order) stream, wetlands would likely have been limited to those areas where groundwater seeps and high water tables were to be found, or where beaver dams may have impounded open water wetlands.

National Wetlands Inventory (NWI) mapping (1986) shows no regulatory wetlands in either Nine Mile Run or the immediately surrounding area. In fact, NWI mapping for the entire city of Pittsburgh shows no remaining wetlands other than artificial ponds and reservoirs. This does not mean that wetlands are not present in NMR. Since the NWI protocol in Pennsylvania employed black and white aerial photography and fairly large minimal mapping units, small, non-open water wetlands were frequently missed. Recognizing this, the Army Corps of Engineers has established an on-the-ground protocol for delineating regulatory wetlands. **(Map IV-b1)**

Based on preliminary field reconnaissance during October and November 1997, it appears that two remnant wetlands exist in the study area (**Map IV-b2)**. Both are **palustrine** wetland complexes dominated by grasses, **sedges**, and **forbs**. The larger wetland, just upstream from Commercial Street, is set back from the north bank some 20 to 30 m and extends upgradient some 30 to 50 m. It has been tentatively classified as a slope wetland according to the Hydrogeomorphic (HGM) approach.[2] The water source is presumably a mix of surface water and ground water; hydrologically, it appears to be linked with the southerly-facing slope extending up into Frick Park. Its position substantially above the bank of the stream and its noticeable cross-slope suggest that this is a low-energy seep system and, hence, is not reliant on flood events. Soil samples taken in November 1997 within the root zone (to 18 in) showed the soil to be **hydric**, with a **chroma** of between 1.5 and 2.0.[3] Hydrophytes are present on site (see Section V-b for a fuller account of site botanical assessment).

The smaller site further downstream along NMR presents a more peculiar situation. Roughly 20 m by 80 m in size and rather

bioregional: having to do with the study of "place" and attention to the region as defined by its life forms rather than by political dictates; "a region governed by nature, not legislature" (Sale, 1985)

hydrological: having to do with the study of water and its properties

biogeochemical: having to do with the study of how chemicals in the earth react with plants and animals in the area

riverine: type of land formed by a river or around freshwater with few trees and shrubs

palustrine: non-tidal, freshwater wetlands dominated by trees, shrubs, rooted aquatic plants, moss, and lichens

sedges: tufted marsh plants with solid stems, in the family Cyperaceae. Many sedges grow in wetlands.

forbs: herbs other than grasses

1 Note that the use of the term "wetland" is not meant to denote a "regulatory wetland" as defined by the Army Corp of Engineers. Detailed wetland delineation efforts are required to confirm the extent and type of wetlands in the study area.

2 The HGM approach categorizes actual wetlands based on idealized characteristics and functions of model reference wetlands. It focuses on wetland position within the basin and hydrological conditions, and also considers soil conditions, energy levels, and vegetation patterns. The HGM approach is becoming increasingly used by wetland ecologists as a functional model, and complements the pattern-oriented U.S. Fish and Wildlife Service classification scheme commonly used over the past several decades.

3 Visually assessed using the Munsell Soil Chart.

hydric: saturated to the point that oxygen is diffused very slowly

chroma: color strength or purity (chroma of 2 or less generally indicates hydric) well-concealed, it is perched on a sloped terrace located just below a 2 m high linear embankment. This, in turn, is situated some 2 to 2.5 m above the streambed. Several test holes dug in November 1997 show a distinct hard clay/soft shale layer within several inches of the surface. Apparently, this functions as an impermeable lens, limiting root penetration and water infiltration, but also setting up hydrological conditions suitable to wetland formation. Root zones as thin as 5 cm were evident in one area toward the down-gradient end of the site. On-site soil sampling showed a soil matrix chroma of approximately 2.0, as well as some **mottling and oxidized root channels** characteristic of hydric soils. Plants species are more predominantly **herbaceous** than the upstream wetland. **Obligate** and **facultative** wetland species include path rush (Juncus tenuis), bullrush (Scirpus atrovirens), wool grass (Scirpus cyperinus), and several sedges (e.g. Carex lurida), as well as herbs such as common boneset (Eupatorium perfoliatum) and sensitive fern (Onoclea sensibilis).

Penn State University's Cooperative Wetland Center has recently included these two sites as reference wetlands within its Pennsylvania Wetlands Study (PAWS). Automated test wells have been installed to assess hydrological dynamics through time. Data from these wells will be compiled as hydrographs—essential in confirming whether these sites are functional wetlands in the regulatory sense. Additional biophysical assessments (soils, vegetation, etc.) will be conducted in Summer 1998. At the present time, biological indicators strongly suggest that, regardless of status, these small ecosystems exhibit wetland-like characteristics that may be of considerable value to both NMR and Pittsburgh in general.

IV-c. Floodplain (Map IV-c)

The NMR floodplain has been severely affected by culverting in the upstream northeast valley of the watershed, and slag fill in the lower watershed. The management goals of the NMR watershed have been principally to protect property and alleviate flooding by conducting flows to the Monongahela as quickly as possible. This method is even obvious in the feeder creeks in Frick Park, where overflow is conducted into the storm sewer and the floodplains have been turned into grassy lawns or childrens' play equipment areas.

IV-d. Lakes and Ponds

There is one pond in the watershed. It is in the upper end of Homewood Cemetery near the entrance off Dallas Street. Appearing to be spring-fed, it has some emergent wetland plant growth. Less than a 0.25 acre in size, it has habitat value in its unique form and relatively protected location.

IV-e. Water Quality

IV-e1. Point Sources

IV-e1a. Water Quality and Flow in NMR (Map IV-e1a)

Sewage pollution has been a problem in NMR since the turn of the century. References to sewage problems are documented as early as

mottling and oxidized root channels: root chanels in hydric soils characterized by oxidized iron

herbaceous plants: plants that are leafy and bush like; not woody

obligate: organisms that need the particular environment they are in to survive

facultative: organisms that can survive in conditions other than the one they are found in

1910 and have continued to the present. Data have been collected for fecal coliform and other pollutants by various organizations over the past 10 years. Several testing sites studied in 1997 have historical data associated with them. The overall impact of sewage discharges is not only represented by the concentration of pollutant, but also by the amount of flow contributed to the stream by a particular source. No historical flow data are available for NMR. As part of this study, flow measurements were performed at the time of some water quality sampling events in order to relate water quality measurements with flow rate information. Samples were taken both in-stream and at the natural tributary and storm sewer influent points adjacent to the stream.

IV-e1b. Sewage Discharge Problems
Sewage discharges to NMR occur via combined sewer overflows (CSOs) and sanitary sewer overflows (SSOs) in wet weather. CSO discharges can occur even during short duration rain events. CSOs commonly are designed to discharge combined stormwater-sewage flows for rainfall events with precipitation greater than 0.1 - 0.3 in/hr (Shamsi, 1997). SSOs behave similarly although their magnitude, frequency, and specific sources are not well understood for NMR.

There are seven documented CSO outfalls that discharge directly into NMR. Five are 24-in pipes that each empty a single diversion chamber **(Map IV-e1b)**. Two of these are located near Duck Hollow **(Sites 17 and 19 on Map IV-e1b)** and three downstream of Commercial Avenue **(Sites 12, 14, 15).** The CSO just upstream of Commercial Avenue **(Site 9)** has a different design. This CSO is a box culvert that runs along Fern Hollow in Frick Park. It is fed by several diversion chambers and is completely open at the outfall, discharging at grade with the stream.

Photo courtesy of Mike Lischte,
Allegheny County Health Department

The culvert terminus at Braddock Avenue **(Site 1 on Map IV-e1b)**, which can be classified as a NMR tributary or as a Wilkinsburg/Edgewood storm sewer, receives a CSO input from the city of Pittsburgh. The diversion chambers are located approximately 1.5 mi away in the Homewood section of Pittsburgh (Pittsburgh, 1995). CSO discharges from this section of Pittsburgh must travel underground through Wilkinsburg and Edgewood before reaching NMR.

Sanitary sewer overflows are perhaps less in volume compared with the CSO discharges during wet weather, but they are responsible for substantial raw sewage inputs to NMR. During a storm event, infiltration and inflow into the sanitary sewers causes overloading which results in either surcharging manholes, or discharge through constructed diversion chambers. There are three documented SSO diversion structures at the mouth of the Wilkinsburg culvert (Pittsburgh, 1997). These SSOs are pipes originating from sewer manholes and discharge during storm events when the manhole chamber is overloaded. Two are associated with an Edgewood sewer and one with a Swissvale sewer. Such diversion chambers help relieve overloaded pipes and prevent manholes from **surcharging**. Whether sanitary sewage discharges occur from manholes or diversion pipes, the result is the same: raw sewage, diluted by stormwater, enters the stream.

surcharge: to fill to excess or overload

IV-e2. Non-Point Sources

IV-e2a. Runoff and Water Quality Problems in NMR

The primary concern with most urban streams is runoff problems during storm events. Every structure, road, and parking lot that is built increases the impact of a rainfall event on the nearest stream. Water that flows into gutters and storm sewers flows into stream channels faster, resulting in greater flows and increased erosion and flood danger. To control these problems and facilitate greater runoff flow rates, urban streams often have been culverted or placed in concrete channels which can lead to runoff problems further downstream.

Photo courtesy of Mike Lischte,
Allegheny County Health Department

NMR is a unique urban stream because it is culverted near its source and on the surface further downstream. NMR is culverted from its source in Wilkinsburg to Braddock Avenue in Swissvale **(see Map I-d1)**. Due to this configuration, runoff flows in the surface section increase rapidly, making the stream "flashy" in nature. This causes accelerated erosion of banks and uneven deposition of sediments in the stream bed.

Along with erosion during high storm flows, there is also degradation in water quality in NMR due to sewer overflow inputs. Fecal coliform bacteria concentrations in the stream often are sufficiently high to render the water unfit for human contact. Sewage pollution problems are a result of shortcomings in the sewage infrastructure system in the watershed. The problems derive from a number of sources within the culverted region of the watershed. CSOs, SSOs, unauthorized sewer tie-ins, and inappropriate stormwater management are among the issues involved.

There are also water quality impacts to NMR during dry weather.
A tributary to NMR that now passes through the slag piles contributes a significant amount of water during dry weather and raises the pH of the stream. Tributaries and storm sewers in the upper half of the watershed sometimes have high levels of fecal coliform bacteria as a result of leaking sewers and unauthorized sanitary sewer tie-ins with storm sewers.

IV-e2b. Sewage Infrastructure in the NMR Watershed

There are three types of sewers within the NMR watershed: sanitary sewers, storm sewers, and combined sewers. Sanitary sewers are typically smaller pipes (e.g., 6 -20 in diameter) and are designed to carry household waste to the treatment facility. Storm sewers channel storm water runoff to the nearest open body of water. Combined sewers carry both sewage and stormwater runoff, and are designed to overflow to natural surface waters in the event of overloading (to prevent backup into homes).

During dry weather, sewage is piped through the combined sewers and emptied into the main sewer lines. Combined sewers pass through diversion chambers which are designed to limit the amount of water that can enter the main line for treatment. Diversion chambers are meant to handle about 3.5 times the normal flow of sewage before they trigger a CSO (Shamsi, 1997). It does not require a very intense storm to create

Community Input

Marilyn Skolnick stated that the plumbing code must be reviewed and changed to make a visible difference in stormwater management.

Peggy Charny mentioned that the new development should be used to model some of the recommended Best Management Practices that come from this study.

Lois Winslow suggested the use of belgian block or other permeable surface material.

It was agreed that we need code changes, but that that takes time, so we should consider modelling some recommended code changes (perhaps in the new development).

John Shombert (Allegheny County Health Department): Because communities share sewers, they could share responsibility for problems when enforcement occurs.

Alex Hutchinson (Contract engineer for the City of Edgewood): If it is found that sewers need to be replaced, joint systems should be considered.
- Television survey results may induce cooperation, e.g., in the building of a common sewer.
- Penn DOT has some responsibility.

runoff 3.5 times greater than normal sanitary sewage flow. During a rainfall event in a community with combined sewers, stormwater runoff is mixed with sanitary sewage and discharged into a body of water.

Communities with separate sewers should not experience sewage discharge problems because household sewage and storm runoff are routed separately. However, SSOs occur when a sanitary sewer becomes overloaded because of infiltration (e.g., through cracks in the pipe or poorly sealed pipe connections) and inflow (e.g., from unauthorized storm sewer inputs from household gutter connections) during storm events. Furthermore, unauthorized discharges of sanitary sewers directly to culverted streams could be a major source of sewage pollution in communities with separate sewage infrastructure. Table IV-e2 lists the types of sewage infrastructure in each community in the NMR watershed.

All sewers within the city of Pittsburgh are combined. Wilkinsburg is equipped with separate sanitary and storm sewage infrastructure. Swissvale sewers that enter the trunk sewer are exclusively sanitary according to a map compiled by Bankson Engineers (Swissvale, 1989). Maps from the I-376 construction show separate storm sewers in Swissvale adjacent to the highway. The separate storm sewer infrastructure in the vicinity of NMR was added when I-376 was constructed.

Table IV-e2. Summary of Sewage Infrastructure in NMR Watershed

Municipality	Type of Sewer
City of Pittsburgh	Combined
Borough of Edgewood	Separate
Borough of Swissvale	Separate
Borough of Wilkinsburg	Separate
Pittsburgh - Homewood	Combined

According to Robert Zischkau, town engineer, Swissvale sewers are separate (Brown, 1997). However, storm sewer infrastructure has not been mapped in detail so it is uncertain exactly how storm water is channeled within Swissvale. Sanitary sewers may be loaded with a significant amount of storm drainage. Edgewood has some separate storm sewer infrastructure. In the Edgewood sewer map, storm sewers run up several streets, but not all of them (Edgewood, 1915).

In the NMR sewershed, the main line for the Pittsburgh combined sewers is a trunk sewer that runs along and beneath the daylighted section from Frick Park **(see Fig. VI)** to the Allegheny County Sanitary Authority interceptor sewer near the Monongahela River. Since 1983, the Pittsburgh trunk sewer has been used by other communities within the NMR sewershed [Fig. III in Appendix IV-e (Chester Environmental, 1995)]. The Swissvale and Wilkinsburg sanitary sewers enter the trunk sewer at the east end of Frick Park. A 20-in Edgewood sanitary sewer meets the trunk sewer just west of Commercial Avenue.

IV-e3. Monitoring

IV-e3a. Historical Data

A report prepared by the Pittsburgh Water Department Laboratory

Community Input

Alex Hutchinson: (Contract engineer for the City of Edgewood)

Commented on Edgewood maps, insisting that they are good.

Commented on potential cooperation between communities: Historically municipalities have worked individually. Wilkinsburg and Swissvale television surveying and mapping of trunk sewer could provide impetus for cooperation; a confederation could work. He believes that roof drains tied directly into sewers are the biggest problem.

Commented on the “why” of no cooperation between municipalities thus far:
- Have been various attempts at cooperation over the years, but momentum dies out
- Political turnover makes it difficult to keep a sustained effort going
- No inertia; ACHD needs to push for action
- Mentioned that parts of Braddock Hills and Forests Hills impact watershed

I will bring these concerns to politicians in Edgewood, will speak with Swissvale engineer (Bob Zischkau) and discuss possibilities for collaboration.

Lois Winslow suggested we need to explore alternative acceptable low cost means to redo the sewer systems with elected officials.

Elected officials must be involved because they are going to be taking the heat if taxes or rates increase and they have the power to form authorities to float bonds.

Patricia Miller (Pennsylvania State Department of Environmental Protection): DEP is addressing sewage issues and will be taking steps soon. Getting communities together first does not hurt, but it will not affect regulatory proceedings.

confirms that the sewage problem existed in 1990 (City of Pittsburgh, 1990). This survey reports high levels of fecal coliform in the stream between Braddock Avenue and Frick Park from March to August of 1990. Samples from Sites 1, 2, and 3 on Figure IV had levels of fecal coliform bacteria consistently higher than 5×10^3 CFU/100 ml at that time, an indication of active sewage inputs to these sites (Brown, 1997). Samples from Site 13 had values ranging from 1,000 to 96,000 CFU/100ml over a 6-month period. For comparison, raw sewage has fecal coliform bacteria concentrations generally more than 3×10^6 CFU/100 ml (Viessman and Hammer, 1993).

Instream data from the Allegheny County Health Department (1997) from 1990 to 1996 show fecal coliform in NMR with an average concentration of about 105 CFU/100 ml. This does not include data taken on January 24, 1992, when exceptionally high fecal coliform concentrations ranging from 2.4×10^6 - 5.9×10^6 CFU/100ml were found instream. These 1990 to 1996 data exhibit great variability with no particular correlation to season. These fluctuations may be flow dependent, but no corresponding flow data were obtained, so investigation of a correlation is not possible.

Instream data from Chester Environmental (1995) from 1991-1992 were also assembled. On August 26, 1991 the concentration of fecal coliform at sampling points instream decreased progressively downstream. This pattern was seen in recent data as well. Data from Chester Environmental on other occasions exhibit variability, ranging from 730 to 51,000 CFU/100 ml. A collection of these and other data corresponding to the current sampling points can be found in Appendix IV-e (Dzombak and Lambert, 1998).

The most recent sampling effort in NMR began in March 1997 by the Department of Engineering and Public Policy (EPP) at Carnegie Mellon University (CMU) in collaboration with the Studio for Creative Inquiry at CMU. Data from this effort are presented in the EPP project report (EPP, 1997). Members of the NMR Greenway Project team continued sampling into Summer 1997. Weekly data for fecal coliform and other pollutant species from the same testing points were obtained.

Samples from NMR were analyzed for several water quality parameters for the EPP project. Along with fecal coliform bacteria counts, samples were analyzed for ammonia, dissolved oxygen, temperature, nitrate, nitrite, pH, and chloride. Although several of these parameters could be indicators of sewage, fecal coliform is the best indicator. Samples were also analyzed for total sulfate. This parameter may be a good indicator of slag runoff inputs and is discussed later in this report.

The average fecal coliform count in CFU/100 ml from April through June 1997 was elevated for each testing site. Samples from Site 1 averaged greater than 104 CFU/100ml during this period. Samples from Sites 2 and 3 were also high, commonly in the 103 range, and up to 32,000 during a storm event. These results are noteworthy because data taken in August 1997 showed much less impact from Site 1, and very heavy impact from Site 3. The data for 1997 are presented along

There are 11 sewer lines crossing NMR over its length of 1.5 miles.

There are five storm sewers which drain the I-376 Parkway.

Community Input

Melisa Crawford volunteered to present an overview of the water table discussion during the second public meeting. Her summary was as follows:

1. Organizational systems for Watershed Management:
    - a. Joint management
    - b. Joint authorities
    - c. Privatization
2. Limitations of Act 167
3. Historic attempts by municipalities to address issues
4. Need to set priorities for solving problems

Marilyn Skolnick mentioned that the odors are a first priority because it is the most obvious sign of the problem.

Karin Tuxen mentioned that that could mean addressing the pools collecting at the CSO outfalls.

with the other historical data in Dzombak and Lambert (1998).

IV-e3b. Recent Data

Beginning in Summer 1997, a more systematic and focused testing scheme was initiated. Fecal coliform was considered the indicator of sewage and several testing sites were the same as in previous studies. However, a distinction was made between the instream testing points and the influent points. All influent points were sampled on a single day so that the impact of each influent could be viewed relative to the others. On alternate weeks, points in the stream were sampled at regular increments downstream to provide a "profile" of the contamination along the stream from Braddock Avenue to Duck Hollow.

A map of the water quality sampling points is found in **Map IV-e1a**. An elaborate description of the upstream sources and a table of the various functions of each influent point is found in Appendix IV.

IV-f. Water Supply

IV-f1. Public/Private

All water in the NMR area is public, supplied by the Pittsburgh Water and Sewer Authority or the Wilkinsburg-Penn Joint Water Authority.

IV-f2. Well Head Protection

There are no wells in the Nine Mile Run watershed.