VII. Management Options

VII-a. Missions and Goals for Greenway Management

The mission of the Nine Mile Run Greenway is to educate and inspire, and to reveal the opportunity that exists in degraded urban landscapes. The tendency to value pristine environments over the landscapes that we access in our daily lives undermines the urban and suburban environment. If we are to reclaim our cultural uses and relationships to urban rivers, we need to carefully consider their opportunities along with their problems. We must learn to see (and teach) the value of ecosystem function in our neighborhood parks, backyards, vacant lots, and daily lives. From the daily practice of attention and care comes the values that will protect and enable a sustainable balance between the built and natural environments.

The following goals envision the Nine Mile Run Greenway as a sanctuary for nature and post-industrial culture in an urban context. They set the framework for management that will help ensure a perpetually flourishing, resilient, and complex ecosystem; one that the people of Pittsburgh will come to cherish and steward as a place of discovery, respite, and inspiration. Because the greenway's vitality depends to a great extent on human influences beyond its boundaries, these goals are proactive in calling for watershed stewardship and open space conservation measures throughout the Three Rivers Bioregion.

Overall Goal

To protect, restore, and enhance the biotic, abiotic, cultural, and scenic values of a post-industrial urban watershed, and to promote public understanding, appreciation, and enjoyment of this heritage within a sustainable greenway program. To achieve these goals, priority will be given to the regeneration, conservation, and communication of key aquatic, riparian, and upland ecosystems with the intent of nurturing an environment which is experientially rich, aesthetically complex, and economically, ecologically, and culturally sustainable.

Natural History Goal

To ensure the health and integrity of the greenway's natural aquatic and upland ecosystems by protecting, restoring, and enhancing ecological and hydrological functions in a manner that results in a more sustainable and cohesive greenway ecosystem.

Cultural Heritage Goal

To reveal, maintain, and celebrate the cultural features of the Nine Mile Run greenway and surrounding area for their inherent value. Cultural elements and systems will be considered for their capacity to illustrate the shifting values evident in the cycles of human use, abuse, appreciation, and regeneration of the natural environment and urban rivers.

Community Input

Catherine Wnuk: Isn't it important to preserve the site as it is? Does it need to be cultivated?

Peggy Charny mentioned how Brown's Hill Road acts as a barrier. Education should be used to get communities not directly tied to the site involved. We need to get the community of Glen Hazel Heights involved. Perhaps this means making the link with jobs. We also need to get schools farther afield from Nine Mile Run involved.

Education and Interpretation Goal
To provide opportunities for students of all ages to explore and learn about urban ecosystems, public space, and river corridors as links between the built environment and nature. Interpretation can be experiential and participatory, promoting a relationship to the urban environment based on principles of sustainable use and stewardship.

Recreation Goal
To enable sustainable recreational opportunities, public safety, and access to diverse user groups throughout the greenway in a manner that is consistent with the above goals; to suffer no net loss of playing fields.

Community Input

Don Gibbon commented on how important it is that the project addresses values and community education; education of politicians, homeowners, and children.

It was agreed that a task force should be devised to address this.

A representative of Dynamo Soccer suggeted that any loss of playing fields be met by a two-for-one replacement.

VII-b. Restoration, Healing, and Ecosystem Regeneration

Restoration, regeneration, reclamation, and healing are terms used in a variety of literature that explores the science and art of resolving ecosystem problems of land and water which have been severely affected by urbanization, industry, or natural catastrophe. The concepts implicit in these terms are important to anyone with a serious interest in urban ecosystems. In light of this, we clarify the language and intent below. As we consider the language of systemic change, it is important to note that the challenge at NMR is defined by the goal of restored ecosystem function, rather than the return to its historic (pre-degradation) form and function. While the latter is the ideal and one of the baselines for planning, the former is the realistic goal for this systemically degraded urban watershed.

Typically, **restoration** is a term reserved for interventions that aspire toward restoring the form and function of original habitats or ecosystems. As William Jordan (1997, p. 115) explains: “Restoration, when successful, results in the creation of an ecosystem that resembles the model, historic ecosystem in crucial (and ideally all) respects.” There seems little merit in this notion as an overall approach to NMR, since the implausibility of restoration in the pure sense for all but some isolated, minimally degraded spots is easily apparent—slag mounds, urban development, and culverted stormwater are a present reality that will continue as primary ecological determinants into the foreseeable future.

More recently, the notion of **regeneration** has been applied to long-degraded urban ecosytems, emphasizing the revival of ecosystem functions without the intent to replicate the form of pre-degradation ecological patterns and native habitats. Regeneration places the emphasis on natural processes that may generate a newly sustainable, albeit altered, urban ecology. This new urban ecology can complement urban infrastructure, and in the case of urban stormwater, provide the potential for dual aesthetic and functional improvement. The regenerative approach tolerates the environmental scars that are almost impossible to erase in urban ecosystems. The functional vitality of the

watershed valley's ecology may be recovered, but pre-industrial indigenous biodiversity, landform, hydrological patterns, and vegetation structure will never be fully re-created.

Another possible approach is found in **reclamation**—a term usually reserved for treatment of exhausted quarries and minelands. The goal is to achieve a more sustainable landcover with fewer environmental impacts while providing enhanced habitat value and improved visual characteristics. This approach has obvious value when we consider the nature of the slag mountain which dominates the river mouth floodplain (see Section VII-e).

The notion of **healing** offers another model, one that operates at the end of the environmental management continuum opposite from restoration. The latter looks back to a rather idealistic, and, in the case of the NMR watershed, a largely unachievable past. The healing approach is concerned primarily with the future, "emphasizing the goal of independence, of getting the 'patient' ecosystem back on its feet, making it [more] self-sufficient, whatever its history might be" (Jordon, p. 115).[1] Both the looking back and the looking forward are important for different reasons. We see merit in the concept of both healing and restoration, embraced by the overarching concept of regeneration within the NMR greenway and larger watershed. We need healing to create ecosystems needed to sustain life, and we need restoration to "conserve the classic ecosystems, communities, and species that are the heritage of the past" (Jordon, p. 115). Moreover, while aspirations for literal restoration in post-industrial urban settings such as NMR are questionable, its utility as a metaphor could ". . .resonate in the minds and hearts of individuals and communities, eliciting meanings and values that are already there" (Whitney, 1997, p. 15). Part of the cultural implication of restoring ecosystem function to urban watersheds would include a healing of the senses. In communities that have had their relationship to nature defined by the extraction and manipulation of resources, this healing can be advanced through the experiences, values, and wonders of a functioning urban ecosystem.

Finally, the ecosystem planning perspective. and its attendant focus on sustainability, should be seen as having a major role in reconciling human use and abuse of NMR. The valley and other remnant open spaces and waterways in Pittsburgh should be viewed as an interacting mosaic of ecosystems, connected by flows of energy and materials. This perspective strives towards a more intentional and harmonious co-existence between members of NMR's biotic community, one that includes humans, native species, and benign naturalized species. Such a conception is both inclusive and realistic, avoiding the pitfalls of anthropo- and bio-centric philosophies of urban nature. *See Appendix VII-B Sustainable Ecosystems Management.*

VII-c General Revegetation Principles

There are a number of well-established principles for restoration plantings in riparian areas and along stream banks. Following are some of the more important points that should serve to guide plantings in the near future.

1. Over the past 30 years or so, the ascendent paradigm of ecology as contingent and stochastic (rather than stable) suggests that there is no such thing as a completely self-sufficient ecosystem at the bioregional scale and smaller. Ecological principles of 'balance' and 'order' have been replaced by the principle of 'ecological gradation' (Soulé, 1995) encompassing a continuum of human and natural disturbances, with degrees of stability or diversity depending on spatio-temporal perspectives. In this discussion, biodiversity is a primary concept. The eminent biologist E. O. Wilson (1992) affirms that biodiversity is the key to global health worldwide. Others note that biodiversity is a key measure of sustainability at the bioregional and watershed scale (*UNCED,* 1992; Riley and Mohr, 1994; Soulé, 1995).

• The greatest limitation of riparian revegetation is that it often does not address the cause of degradation or stress; when it does not, it is likely that the riparian system will continue to be unstable (Briggs et al., 1994). An understanding of water, sediment, and energy fluxes is essential to selecting the appropriate species, designing the soil profile, and determining whether plantings are even the correct solution (Harris and Olson, 1997). In particular, episodic flooding common to NMR can render new plantings vulnerable (Hawkins et al., 1997). The involvement of a stream hydrologist and fluvial geomorphologist is essential to ensure successful long-term restoration.

• Focus on common pioneer and quick-growing native tree species that are found in the immediate area of NMR or in nearby, reference sites. Trees such as willow, dogwood, poplar, and river birch are tried and true lowland restoration species, and presently grow within the NMR watershed.

• Allow enough time for locally-collected cuttings and seeds (local genotypes) to be grown by either volunteers or contract growers; commercially-available stock is often not adapted to the local situation.

• When gathering seeds and propagules, collect from different stock plants to broaden the genetic diversity of the plantings in order to enhance the overall biodiversity of NMR.

• Collect seeds and propagules in such a manner as not to jeopardize natural stands or significantly deplete the plant source (again, collect from several different individuals so as to obtain a representative sampling of genetic material).

• Err on the side of resilient lowland species: sandbar, black and pussy willow; redosier, gray, and silky dogwood; smooth and speckled alder; river birch; silver maple; American and slippery elms; green and black ash; chokeberry; cottonwood; sycamore; elderberry; basswood; red and silver maple; and viburnums. Where workforce and money are constraints, consider a successional strategy that starts with early colonizers, then underplant with a variety of other slower-growing and somewhat shade-tolerant species.

• Native shrubs can play an important role in diversifying the characteristics of the habitat, protect soil from erosion, and help shelter the edge of tree plantings. Make use of evergreens on the up-gradient sides of larger plantings to establish an interior habitat in a more timely fashion.

• As with stream restoration (see Section VII-g), riparian revegetation should aspire to natural diversity and structural complexity. Provide variation in topography (see below), species, age, and density to maximize biodiversity.

• Rescue plants from nearby donor sites slated for development. For instance, the LTV site has a supply of willow and poplar that would be suitable for cutting and bare-root stock.

From *The Ecology of a City Park, Frick Park, Pittsburgh, PA*, by William L. Black (1947).

Protecting the native and introduced animal life produces interesting and paradoxical situations. Protected hawks, owls, and crows prey on nesting and migratory birds. Raccoons, skunks, and opossums often destroy the nests of rabbits and pheasants. The urine of dogs kills evergreens, but the feces and urine- soaked grass provide a habitat for certain types of flies. Dogs and cats kill rabbits, squirrels, chipmunks, mice, moles, and shrews. These smaller mammals often damage or kill introduced plants. Quail have been eliminated from the creek areas for years, possibly by Cooper's Hawks, cats, and hunting dogs. The anti-pollution laws have not prevented the elimination of amphibians, reptiles, fish, and water insects in Nine Mile Run, nor have the laws, publicity, or education forced the responsible communities to contain this sewage.

• Consider the potential benefits of restoration technology: Tubex® tree shelters and deer and rodent repellents are essential; the new VisPore tree mats are an interesting alternative to standard mulch; polymer soil conditioners and mycorrhizal innoculants are worth investigating.

• Conduct research on locally available biotechnologies in concert with on-going studies of stream morphology for specific application along degraded and threatened reaches of the stream. These technologies are usually to be preferred over static bank stabilization measures such as concrete and gabions, which often fail in grand style and provide little habitat value.

• Incorporate the notion of accessibility and visibility into site selection criteria; those projects that are open to public scrutiny and easy for all to access can play a major role in building an inspired NMR greenway constituency. Denuded stretches along the creek just up- and downstream from the Forward Avenue crossing are excellent spots for revegetation, as are riparian areas near the playing fields and along the more visible stretches of Fern Hollow.

• Likewise, ensure that initial projects are successful. Nothing dampens community and agency enthusiasm like failure.

VII-d. Management Issues

VII-d1. Management of Rare and Endangered Species

Native rare species and significant/sensitive habitats have been identified in the background research. PNDI species should be addressed through the standard protocol, as guided by botanists and biologists with the Carnegie Museum of Natural History. In planning the exact location of trails, trailheads, and other facilities and programs, important habitats should be avoided to minimize trampling and wildlife disturbance.

A multi-disciplinary approach (designers and scientists) should be encouraged as a prelude to any specific installation or program application. Access by researchers and educational groups should occur only by permission of the greenway's management authority when it has been established that the greenway values will not be affected. Except for carefully planned and monitored greenway activities, native species should not be disturbed or removed unless under an approved research permit.

VII-d2. Management of Wildlife and Feral Pets

As documented in previous sections, NMR greenway contains a fairly significant diversity of animal species. The emphasis of management should be on allowing the greenway's native animal populations to develop with as little human intervention as possible. This policy will require the management of people and related land uses.

Deer management is a potential challenging issue, although the extent of the problem is not clear. Other urban and near-urban greenspace systems have grappled with the problem of excessive browsing of native vegetation for some time (Robertson, 1994). With an absence of natural predator-prey relationships, deer have often achieved unsustainable densities of up to 60 deer per square mile. Natural background levels for rural and near-urban landscapes have been variously quoted at between 10 and 20 deer per square mile.

Deer seem to be especially attracted to new plantings. Robertson and Robertson (1995) have seen some success with the application of Anipel (also known as Bitrex), a bitter-tasting systemic deer and rodent repellent. Treeshelters have become almost a necessity in revegetation projects. Many other techniques can and should be considered by greenway managers; sustainability principles discussed above should be adhered to.

Maintenance of appropriate population levels should be a priority. Preservation and reinforcement of natural linkages both within the greenway and between the greenway and Frick Park and the flanking slopes of the Monongahela River should be supported. This would permit the migration of deer and other species, thus easing the potential pressures of browsing and other effects of overpopulation due to habitat isolation. The advice of the Pennsylvania Game Commission should be sought, as should the opinion of those urban open space managers with more experience, such as Pennypack Wilderness Preserve and Valley Forge National Historic Park.

Other wildlife has the potential to become a nuisance. This tends to occur where greenway maintenance is lax (e.g. raccoon feeding at waste receptacles) and hand feeding takes place. Canada geese graze on turf, and may cause significant water quality and aesthetic problems. Greenway managers should watch for such problems as the greenway returns to a state of enhanced ecological integrity; county extension professionals and biologists are readily available for consultation. To the greatest extent possible, wildlife should be managed through appropriate ecosystems-based strategies. For example, areas of low-growing, high-nitrogen turf would be replaced with native, taller-growing meadow species to discourage geese grazing.

Loose-running domestic pets and feral ("wild") domestic species, largely cats and dogs, have known impacts on native fauna, particularly ground-nesting birds, low and mid-canopy songbirds, and small mammals. Wildlife management in NMR should incorporate a baseline study and monitoring protocol of actual impacts as well as establish specific mechanisms for control. One key aspect of prevention should be the initiation of education programs to heighten awareness of this problem. Pets should be under the owner's control in the greenway, and should be prohibited from running free in the stream. A "stoop-and-scoop" policy should be enforced.

Community Input

Sarah Dixon: There are large numbers of deer and raccoons in Hazelwood, do they move around?

Barbara Balbot: Deer cross Forbes Avenue into neighborhoods and eat in peoples' yards, thus, many people do not appreciate them.

Blair Jones: Could there be a target study for animal diversity, coyote for example, to control deer population?

Ken Tamminga: Could work with the fish and game commission to keep a sustainable herd.

Blair Jones: What is a sustainable herd?

Ken Tamminga: 10 to 20 —larger usually cause regional vegetation problems. The herd can be controlled through sterilization, sleep drug, bow hunting, etc.

Peggy Charny: Frick Park off Beechwood is overun with unleashed dogs to the point of being dangerous at times.

Community Input

Questions from the Second Public meeting:

Is NMR different from other natural areas in terms of plants and insect population and diversity?

What invasive plants exist on site?

What is the best way to deal with the invasive plants?

Where are the invasive plants?

VII-d3. Management of Human Predation and Destruction

Illegal harvesting of plants, animals, and material has probably been occurring in NMR for decades, although this is not well-documented. The killing of wildlife such as native snakes, the picking of spring wildflowers, harvesting of fiddleheads, mushrooms, and other wild edibles—these and similar actions adversely affect species, natural communities, and the local environment (Dawson, 1991). Appropriate state regulations and greenway policies should be enforced. Greenway visitors and surrounding residents should be encouraged to become stewards in monitoring and reporting illegal and damaging activities. A proactive program of public awareness and education should be considered as part of more detailed management strategies.

VII-d4. Management of Invasive Plants

Invasive plants are a highly significant reality in NMR. As discussed in Section V-b, invasive patterns of disrupted soil regimes, industrial fill, impoverished growing conditions, and a readily available source of invasive species propagules combine to create an optimum culture for invasive species. However, because a range of natural and cultural values are at stake, it is wise to begin assuming responsibility for management and control of invasive plants in NMR and throughout the watershed. Three approaches can be identified. For comparative purposes, several of the species of primary concern in NMR will be addressed in each.

1) <u>Direct management</u> primarily involves application of physical, chemical, and biological interventions to the stand of invasive plants. Seedlings of tree-of-heaven, for instance, are easily pulled by hand before the development of the tap root. Applying this same approach to honeysuckle is a recipe for disaster since any disturbance simply provides opportunity for honeysuckle and other invasive species seeds (particularly garlic mustard) in the soil to sprout. Simply cutting honeysuckle and many other invasive shrubs and smaller trees is also frequently a waste of time since it results in resprouting and even more aggressive growth habits. Increasingly, natural area managers have advocated direct management through chemical means: the application of a non-persistent systemic herbicide such as Roundup® to cut stems and stumps to effect a complete kill with minimal soil disturbance. Biological interventions—usually the introduction of a herbivorous insect originating from the same source as the invasive host plant—is often considered where physical and chemical approaches have shown to be ineffective. A well-debated body of literature promotes integrated pest management (IPM, a technique adapted from greenhouse management) to discern the best direct management approach through time. It selects from, or combines the best of mechanical, biological, and chemical means of control of pest species.

Directing ecological succession is a common secondary management effort, often entailing the inter- or under-planting of robust, early successional native woody and herbaceous species. The objective is to out-compete invasive species. For example, after an initial round of honeysuckle eradication, riparian slope species common to NMR such

as ash, slippery elm, willow, or redosier and gray dogwood (*Cornus* spp.) can be interplanted to facilitate canopy closure and root competition in an effort to reduce honeysuckle re-sprouting.

2) Indirect ecological management is gaining momentum as a more 'holistic' approach to dealing with aggressive non-indigenous plants. It stresses the importance of early plant detection, modification of human activity, and manipulation of system attributes as components of an ecological approach to modifying plant invasion (Hobbs and Humphries, 1995).

Some scientists feel that the most effective approach to long-term control of exotic pest plants is removal of the conditions that give these species a competitive advantage (Whiteaker, 1993). In NMR this may be more unrealistic than in most open space units; there will always be in external influences and a built-in disturbance regime (e.g. slag piles, flashy hydrology, and damaged soils) resulting in internal stresses which will require on-going and direct management.

For example, there is little precedent for successful indirect management of honeysuckle where extensive thickets are already well-established. A literal interpretation of the indirect approach would see the wholesale removal of slag fill and the reestablishment of pre-disturbance landform, soil, and hydrological regimes—"restoration" in its pure sense, as discussed above.

Once control and native revegetation tactics prove successful, indirect ecological management becomes more feasible. For example, management of hiker, mountain bike, and deer movements would reduce trampling and exposure of the seed bank, thus limiting the potential for invasives such as garlic mustard to become re-established.

3) The do-nothing option is a time-honored management option that is gaining renewed interest, albeit with ecological overtones lately. Eastman (1995) argues that there is no definitive solution to the challenge of invasive species and that therefore we should tolerate them as best we can. He cites community self-regulating mechanisms (herbivory, diseases, etc.) for their ability to moderate invasive dominance over the long term. The invasive plant is eventually integrated into a stable but changed ecosystem.

That NMR is a disturbed ecosystem within a fully urban watershed might work in favor of the third approach. However, this stance can be seen as fatalistic because it side-steps the real progress made in restoration ecology and reclamation science over the last decade. And it bespeaks an inherent pessimism: that any human intervention is, in the long run, bound to fail. Many precedents contradict this stance. NMR has been actively degraded for many decades. It will take several decades of active ecological management and restoration to recover a semblance of ecosystem function. Finally, the do-nothing option under-emphasizes the extensive damage invasive plants have inflicted on stressed urban ecosystems across the continent. NMR's ecological

Community Input

Peggy Charny mentioned that the city has a hard enough time maintaining the parks as it is, let alone adding anything new.

Bob Hurley mentioned that the Pittsburgh Parks Conservancy is addressing this issue.

Community Input

Catherine Wunk: Would it help to publish a list of invasive species? Do wildflowers help enhance insect population diversity?

Jack Solomon: Is it possible to introduce more wildflowers to the site...even if invasive?

function and stability have been heavily degraded; the more clearly this is documented, the more we are obligated to rectify the situation in favor of native and benign naturalized life forms.

We consider the application of new ecological knowledge within an adaptive management approach—where monitoring and responsive-but-cautious interventions are essential to both long-term success and a heightened understanding of ecosystem dynamics—to be the most appropriate approach for NMR. Priorities for control or removal of invasive species should be directed at those that pose the greatest ecological threats, namely those that (SER, 1994):

- replace indigenous key species or rare and endangered (PNDI) species;
- substantially reduce indigenous species diversity, particularly with respect to the species richness and abundance of conservation species;
- significantly alter ecosystem or community structure or functions;
- persist indefinitely as sizeable sexually reproducing or clonally spreading populations;
- are very mobile and/or are expanding locally.

When considering vegetation management approaches in such a deceptively "green" corridor as exists along the lower elevations of NMR, it is important to make the distinction between "invasive"/"pest" plants, and those that may be non-indigenous. The latter may be benignly naturalized in their ecosystem context and may contribute some values such as habitat and seasonal beauty. The essential point is not whether a plant is "native" or "non-native," but whether it serves the larger interests of ecosystem health and integrity. In perpetually stressed environments such as NMR, some tolerance is certainly in order for both pragmatic and didactic reasons.

Further research is required to understand specific threats that may be present from NMR's invasive plant populations. Several species pose a rather philosophical challenge. For example, one response to the stoic tree-of-heaven might be admiration and the "better-this-tree-than-no-tree-at-all" observation. Hough (1995) stresses the validity of some introduced species in stressed urban environments. Their natural history (they frequently originate from long-disturbed European ecosystems) often matches perfectly with the disrupted conditions on site—a clear urban ecology lesson.

Others have pointed out the fallacy in this as a long-term management response. Robertson (1995, p. 65) notes that "in the long run, proliferation of highly invasive and competitive alien trees often leads to reduced diversity. The exotics are also invasive in a subtler, psychological sense. The lush, green landscape they create can produce the illusion of an intact ecosystem where, in fact, many species have been lost and complex relationships disrupted." While the tree-of-heaven on the more open slag slopes and plateaus appears to be growing synergistically with other smaller pioneering species, their role on more advanced successional slopes and in riparian areas can be

questioned.

Some species represent, however, a much higher order of impact. **Appendix VII-?** contains a list of plant species that preliminary site investigations have suggested should be high priority considerations for control. While control techniques have been profiled above, each species should be the subject of a custom-tailored control and monitoring protocol. We strongly suggest that botanists with the Carnegie Museum of Natural History be involved in this on-going endeavor.

VII-e. Recovery of Riparian Plant Communities

Vitally important to the long-term ecological health of the NMR greenway is the ecological integrity of its riparian slopes and stream banks. This linear zone is, along with the aquatic ecosystem, the lifeline of the greenway, providing the primary ecological conduit for materials, energy, and species between the Monongahela River valley, Frick Park, and the upper watershed. Riparian and lowland vegetation provides a conduit for the in- and out-migration of animals and—over longer periods of time—plants. Biotic movement in NMR is not only important for immediate species richness, but to ensure that genetic communication takes place between isolated populations, thereby increasing their viability (Ambrose, 1992). Frick Park and the Monongahela valley therefore are seen as important sinks of natural genetic material.

Riparian vegetation also provides important values for NMR's aquatic environments. Overhanging trees and shrubs provide organic detritus that is invaluable to fish and macroinvertebrates. Shade provided by bankside vegetation helps maintain cooler water temperatures; streambank vegetation also provides a resilient and regenerative means of erosion control. Finally, riparian and lowland vegetation provides widely acknowledged habitat value.

In contrast to the slag slopes, much of NMR's riparian and floodplain ecosystems are fairly well vegetated, although often with non-native species. Rather than the comprehensive program for regeneration called for on the slag, these habitats require a more surgical approach to dealing with the problems of erosion, soil degradation, stretches of riparian-based slag, cultural intrusions such as mown turf and mountain bike trails, and invasive species control.

Since there are so many opportunities for small restoration initiatives on riparian slopes and along the stream bank, specific designated sites will not be identified herein. Rather, some general approaches are discussed below which should guide restoration plantings in the near future. Also, further studies must be conducted regarding **hydrogeomorphic** conditions, **stream morphology**, sediment transport, soil characteristics, and wetland delineation prior to establishing any significant restoration initiatives. Obviously, plantings in areas likely to be subject to stream remediation or wetland creation

work would be premature. Lastly, several issues discussed previously (such as the use of plants of local origin, biotechnology, etc.) apply equally well to riparian ecosystems and should be referenced.

VII-e1. Microtopography Duplication

There are several low-lying and poorly developed areas along NMR that present an opportunity to restore mound-and-pool **microtopography**. This phenomenon has recently been the focus of restoration ecology research. Initial findings suggest that the hummocks and hollows created through wind-throw and root wad tip-ups provide an ideal growing environment for a wide diversity of both wetland and somewhat more mesic plants. The utility of this technique for the restoration of depressional wetlands—such as identified just downstream from the playing fields—is discussed in Barry, et al. (1996). He notes that with this approach the margin of tolerance is increased and that both wetland obligate and facultative species may be accommodated in low and high spots, respectively. This technique should also be explored for some of the more denuded and invasive-species infested areas of the lowland forest.

VII-e2. Monitoring

Monitoring is a necessary part of any riparian and aquatic restoration program (Kershner, 1997). Increasingly, resource management agencies are lengthening the period of monitoring, as it becomes clear that ecosystems dynamics take some time to appear. Short-term monitoring protocols have often spurred "instant" solutions which fail soon after observations ended and may not have been beneficial to the ecosystem in the first place. For wetland restoration, Barry, et al. (1996) cites the appropriateness of the Army Corps 404 permitting schedule, which calls for a 10-year monitoring plan and monitoring reports at the first, second, third, fifth, and tenth years following installations, as well as identifying any remedial actions. Even for very small or simple plantings, procedures should be documented and results tabulated for application to future projects in the valley and around the Three Rivers Bioregion. Also, it should be ensured that a record of stock source is obtained and deposited in a secure source, such as the Carnegie Museum of Natural History herbarium.

VII-f. Regeneration on Slag Slopes

The dysfunctional characteristics of the existing slag slopes are well-documented in this and prior reports. It is clear that the ubiquitous nature of the slag presents a complex challenge. Published research on similar precedents is scarce. Rather than thinking of slag as a "constraint" to be "overcome," perhaps it presents an opportunity in creative learning, a potential contributor to the continuing story of the culture-nature continuum so evident in this valley.

Saunders suggests that experimental ecological projects can "induce learning, encourage innovative thinking, and provide flexible opportunities to test new ideas" (1997, p.119). Smith, et al. (1997) have noted that both naturally occurring catastrophic events and human-induced mega-disturbances such as large slag dumps provide unique opportunities for studying forest development, primary

hydrogeomorphic: the study of changes which occur in the land due to its relationship with flowing water

stream morphology: the changes in the stream bed due to the erosive and depositional (creation of sand bars) nature of streams

microtopography: the smallest scale of topographic analysis

succession, and ecosystem recovery.

By looking at regeneration on NMR's slag lands as experimental, there is an opportunity to watch, measure, tinker, and demonstrate to a wider brownfields constituency. This approach overtly acknowledges that there is (as yet) no one tried-and-true technique that conventional reclamation may, in fact, hinder other, more creative solutions. Pittsburgh's public and stakeholders will surely understand built models better than conceptual ones. Perhaps most importantly, an experimental approach will provide one of the more important scientific bases for ecological management and design of this brownfield site and others like it. It can provide insights that currently do not exist. If the mechanisms that cause vegetative change are understood, then they can be exploited to manipulate vegetation, and the results of these manipulations can be predicted more reliably (van der Valk, 1988).

What is the range of possible approaches to the slag slopes? Short of wholescale relocation of the slag elsewhere, which is indefensible from a sustainability perspective, possibilities range from conventional regrading to standardized gradients (e.g. 2:1 or 3:1), application of imported topsoil and hydroseeding with pedigree turf, to quite unorthodox and ecologically-intriguing solutions incorporating natural successional processes.

Hodge and Harmer (1995) profile five general approaches to woodland creation on difficult urban and post-industrial sites characterized by high levels of environmental stress (drought, pH extremes, etc.). We have reconfigured the profile somewhat in the table on the next page, and added a sixth approach to clarify the continuum. The descending order of approaches illustrates the full range of regenerative approaches to revegetation, moving from the natural selection and competition which occurs in nature to increasingly intensive management. It could be argued that the goal of a sustainable post-industrial vegetation regeneration is an approach which provides the most experiential-aesthetic benefit while achieving an equitable balance between management costs and ecological risk.

Natural colonization (Approach #1) is clearly evident on the northerly, older slag slopes. This presents the most immediate and relevant reference site for reclamation of more open slag slopes. As noted earlier, however, the mid-successional slopes may embrace subtle differences, attaining a tolerable growing culture not yet evident on open slopes. The relative stability of surface aggregates and the possible presence of mineral soils may both provide just the level of sustenance needed to stimulate vegetative growth. On the other hand, existing vegetated slopes are older than the open areas (Prellwitz, pers. comm.) and have had a longer time to vegetate.

It is forseeable that given time, natural succession may yet prevail on all slopes. The most analogous study available, on an old iron slag site in North Canaan, Connecticut, investigates a 75-year old, moderately high pH slag dump (Smith et al., 1997). It found that the accumulation of nutrient capital, largely organic matter from nearby forests and production of organics *in-situ,* was sufficient to establish appropriate

Table Based on Hodge and Harmer's (1995) profile of five general approaches

Method	Management	Planting	Failure rate /Time to establish
1. natural colonization	no mngt.	natural selection	low/decades
2. nurture colonization	low-intensity mngt.	natural selection	low/3-10 yrs
3. natural planting	low-intensity mngt.	site-informed selection	medium/1-5 yrs
4. nurture planting	mid-intensity mngt.	site-informed selction	medium/1-3 yrs
5. ideal-driven plntng.	mid-intensity mngt.	idealized plant selection	medium-high/instant-1yr
6. forced-ideal plntng.	high-intensity mngt.	idealized plant selection	high/instant-1yr

mesic soil conditions on both plateau and moderately steep side slopes. Floristic patterns and size of white pine (*Pinus strobus*), oak, red maple (*Acer rubrum*), grey birch (*Betula populifolia*), white ash, and eastern hemlock were similar to nearby second and third growth woodlots (Smith et al., 1997).

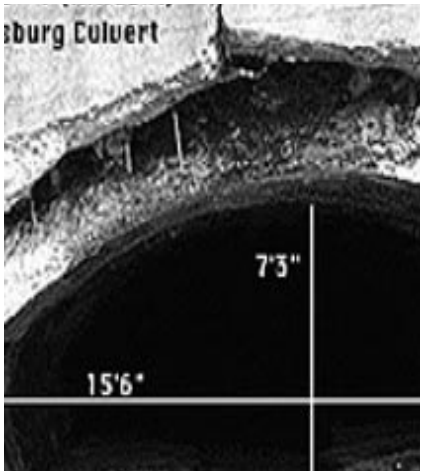
Nurture colonization, natural planting, and nurture planting (Approaches #2, #3, and #4) are the models that we suggest may prove most fruitful for Nine Mile Run. These accept that some sort of accelerated vegetation, or 'kick-starting,' will be necessary to help restore greenway ecosystem functions and enhance open space aesthetics in concert with the proposed development on the slag plateaus. Approaches #2 and #3 work with natural processes, but are not adverse to translating contemporary knowledge in restoration ecology and reclamation science. Approach #4 takes into account the challenging conditions of germination, and closely manages the first two years of growth. A number of variations within these general approaches are included in **Appendix VII-??**

Ideal-driven planting and forced ideal planting (Approaches #5 and #6) represent conventional models that have in the past appealed to managers of high-use urban open space. They tend to be driven by economic or visual criteria, rather than ecological principles. Each entails a visually ideal choice of plant materials which may not be suited to the constraints of the environment and therefore requires increasingly intensive management and an elevated risk of failure.

These approaches present an expensive, and perhaps, even imprudent scenario, given the challenges of the site. Whole-scale planting of non-adapted woody species on stressed brownfields sites such as NMR is risky, and far from sustainable. Rather than work with natural processes through time, these approaches invariably rely on frequent and heavy dosages of fertilizer, pesticides, and soil admixtures, as well as a high level of human effort. Furthermore, such approaches usually utilize non-native species with low habitat value. Clearly, an intensive "pedigree" approach to slag slopes is inconsistent with ecosytem design and sustainability principles.

Any number of experimental and adaptive management techniques which emulate ecological processes could be explored within the general #2-#4 model. The establishment of baseline conditions is

essential. For instance, a thorough lab analysis should be conducted of soils from all areas identified for test plots and subsequent managed colonization and low-intensity plantings. Samples should be taken in each plot and tested for available nutrients, metals, pathogens, seed banks, pH, phenolic compounds, and other standard reclamation indicators (Majcher, 1997). Results should be analyzed by an experienced soil scientist or reclamation ecologist, and made relevant to the design of experimental/control plots.



culverted tributary

VII-g. Stream Restoration

VII-g1. Upstream Testing

Fecal coliform testing should be expanded upstream of the daylighted portion of NMR. Site 3 branches out in three directions on the other side of the I-376/Braddock Avenue interchange. Each branch should be tested to pinpoint the source of constant sewage pollution that is discharged from this influent to NMR. The 16 ft box culvert at Braddock Avenue (Site 1 on **Map IV-e1a**) has several branches that could be tested. Testing three to five strategic locations in Edgewood and Wilkinsburg would be extremely beneficial for narrowing the possible sources of sewage during dry weather and perhaps wet weather. Sites 2 and 6 have daylighted portions that could easily be tested. Should these sites become a greater impact on NMR as the weather changes, testing could be moved upstream. Site 11 could be tested further up, though it must be traced first. This pipe is currently not mapped with the city of Pittsburgh sewers.

culverted tributary

VII-g2. Detailed Sewage Infrastructure Mapping and Assessment

A necessary first step toward repair or renovation of the sewage infrastructure in the NMR watershed is mapping and assessment of infrastructure. The Allegheny County Health Department is currently compiling sewer maps from the four municipalities that can be used to evaluate the sewershed as a whole. This sewershed mapping is critical for evaluating and mitigating sewage impacts on NMR. A rigorous field verification must be performed to assure that the digitized maps reflect what is in the field. Discrepancies have been found, for example, between the CADD map of Pittsburgh and the actual locations of manholes and stream crossings. Field surveying of selected manhole locations, invert elevations, and other features is needed to ensure accurate mapping. In conjunction with the mapping effort, inspections of selected sewers and culverts are needed. Visual and television inspections typically are performed in such efforts. An assessment and inventory of all influent pipes would help identify unauthorized tie-ins. Such tie-ins clearly exist and it should be possible to identify a significant number of them rapidly. Inspections will also identify pipe blockages that contribute to SSO problems.

Up-to-date sewershed mapping combined with inspection data should make it possible to determine areas where stormwater is likely to be entering the sanitary sewers. Possible sources include roof gutters piped directly into sanitary sewers or sanitary sewer manholes on the streets acting as storm drains. Also, the non-existence of actual storm

Community Input

Patricia Miller (DEP): DEP is addressing sewage issues and will be taking steps soon.

John Smith: The DCNR is a sister organization to the DEP. The NMR problem is a Health Department/DEP issue. When will action be taken? It has been requested by various members of the citizenry for over 8 years!

Holes have been identified within 100 yds of the Braddock Avenue culvert (a culverted tributary). This significantly affects stream flow and may be adding to SSO and chronic discharge loading of sanitary sewers.

Other problems encountered in this initial inspection tour included toilet paper and fecal deposits on the culvert floor beneath lines which are tapped directly into the culvert.

sewers in some areas may be an important problem.

The possibility exists that the current sanitary sewers in Swissvale, Wilkinsburg, and Edgewood are under capacity for the volume they handle during peak hours. Up-to-date sewer mapping will facilitate investigation of this possibility which should be evaluated. A detailed sewer mapping and inspection program will identify readily fixable problems (e.g., pipe blockages, unauthorized sanitary sewer tie-ins to storm sewers) that could be the source of a significant fraction of the water quality problems in NMR. The maps and data obtained would also serve as the basis for long-term planning regarding sewage infrastructure.

VII-g3. Watershed Stormwater Management Program

A significant part of the sewage contamination problems in NMR is related to current stormwater management practices. Stormwater management should be reevaluated on a watershed-wide basis. A task force focused on the problems of the NMR watershed, with representation from the governments of all four watershed municipalities, should be created to look at the problems as a whole, and a stormwater management plan should be developed. This plan could include enhancement of stormwater infiltration in the watershed, restoration of stormflow in subsurface or surface basins, including wetlands, and other measures (see Appendix VII-g, wetlands are addressed in Section V). With such a plan, local efforts can begin on a variety of aspects in a coordinated manner. Proper separation of stormwater and domestic sewage within the NMR watershed is vital to the long-term mitigation of sewage problems in NMR. Also, the mitigation of other problems, such as high peak flows, will be best addressed through localized but coordinated efforts throughout the watershed.

VII-g4. Pittsburgh NPDES Permit Conditions

A long-term plan to upgrade the sewer system in the east end of Pittsburgh should be among the requirements in the NPDES general permit for Pittsburgh CSOs. A solution to the awkward CSO configuration discussed in this report, namely the CSO discharge to the NMR culvert in Wilkinsburg, should be a condition in the permit.

Community Input

Bob Zischkau: Will the study describe the actual physical problems?

Jim De Angelis: Volunteerism is great, although there is some evidence of cooperation at Nine Mile Run, compliance comes from the outside. Will the Nine Mile Run report be specific enough, airtight, and able to force the four municipalities to comply with the law?

What evidence will you bring to bear that will force the municipalites to act on this issue? Otherwise you're wasting the state's money and the citizens' time.

VII-g5. Modifications to CSO Discharges

The odor impact in dry weather from both CSO and SSO diversion chambers is an important aesthetic issue relevant to NMR. Flap gates on all the CSO discharges would improve the odor problem significantly and could be implemented in the short-term. Flap gates may also help reduce odors from the three SSO discharge pipes at Braddock Avenue by breaking the direct path that exists between the sewage and the open air.

The stagnant pools associated with two CSO discharges (Sites 9 and 12 on **Map IV-e1a**) should also be addressed in the short term. This problem could be fixed relatively easily. The pool at the outfall downstream of Commercial Avenue could be adjusted with some skillful

backhoe work. The outfall in Frick Park may take some redesign because the bottom of the chamber is at stream grade.

A Pittsburgh Sewer and Water CSO with a standing odiferous pool, just downstream from Commercial Avenue.

VII-g6. Stream Odor Survey

Although general observations have been made regarding odor problems around NMR, a separate detailed stream odor survey is highly recommended. Odor problems have been confirmed in the vicinity of CSOs and SSOs specifically. A survey of the entire stream along its length at different times would be beneficial, as no comprehensive inventory has been documented at this point.

VII-g7. Stream Erosion Survey

Several sections of Nine Mile Run show signs of accelerated bank erosion. A detailed study should be carried out to inventory the extent of the damage already done and to identify the most serious problems. Bank stabilization options could then be considered. The “flashy” nature of the watershed cannot be changed readily. However, some measures could be taken to reduce energy in the flow, perhaps by placing baffles or large stones in the concrete channel. The ideal configuration for such energy dissipation measures will require further study.

VII-g8. Use of Constructed Wetlands for Remediation at NMR

Constructed wetlands may be potentially useful for helping to mitigate both water quality and flow problems in NMR. Constructed wetlands have the potential for reducing fecal coliform bacteria concentrations in the water through the sedimentation and attachment to plants (Gearheart, 1997). A wetland could be designed as a passive system, where streamwater in NMR passes through wetland plants, providing some water quality benefits. A wetland may also be part of a managed treatment system designed for optimal water quality improvement. There are several constraints in NMR that appear to limit potential water quality benefits of wetlands. The DEP requirement of less than 200 CFU/100ml of fecal coliform bacteria for human contact could not be guaranteed on a consistent basis for an unmanaged wetland. Creating a managed wastewater facility, using wetlands as part of the treatment process in a city park to help resolve sewage infrastructure problems in other municipalities, may be viewed by many as an inappropriate use of public space. Furthermore, wetland treatment efficacy is directly related to detention time, which is determined by wetland depth and area, so high flows and minimal available land in the floodplain complicate the use of wetland solutions. Finally, in NMR there are major constraints related to consistency of flow in the stream. Flows in the summer can range from nearly stagnant to high storm flows, and the latter would need to be diverted from the wetland via an engineered diversion structure in the stream.

University of Pittsburgh Ph.D. candidate in geology, Henry Prellwitz, surveys a bank erosion problem with a member of the project team.

VII-g8a. Wetland at Low Flow

A wetland that is bypassed by high storm water flows could benefit low-flow water quality in NMR, but is unlikely to provide a complete solution to the water quality problems during dry weather. Significant reduction of fecal coliform bacteria has been achieved in wetlands (Hammer,

1989), in some cases up to several orders of magnitude reduction (Kadlec, 1996). However, constructed wetlands which have provided high removal efficiencies are managed facilities, such as the Arcata Marsh and Wildlife Sanctuary in California (EPA, 1993). Although some removal of fecal coliform bacteria could be expected in a wetland in NMR, additional disinfection treatment will most likely be required to reduce bacteria to the PADEP standard for human contact (200 CFU / 100ml) on a consistent basis. Meeting a discharge standard below 500 CFU/100ml may be difficult because of natural levels found in wetlands having significant wildlife activity (Kadlec, 1996).

The potential benefits of wetlands in NMR is highly dependent on the goals of water quality improvement in NMR. The PADEP standard for human contact of 200 CFU/ 100ml may be not be a realistic goal in an urban stream such as NMR, even during dry weather with no active sewage discharges. (For example, coliform levels in Frick Park's Fern Hollow, which does not receive direct sewage inputs, ranged from 200 to 800 CFU / 100ml during Summer 1997). If the goal is merely to achieve some water quality improvement downstream, passive treatment through a constructed wetland is likely to provide some positive benefit. However, such an approach to water quality improvement in NMR would amount to treatment of symptoms. Investigation and development of a mitigation plan for unauthorized dry-weather sewage impacts should be undertaken prior to deciding upon the role, if any, for wetlands as treatment units.

VII-g8b. Wetlands in the Treatment of Storm Flows

A wetland could only be effective for treatment of wet weather pollution if all the stormwater for storms of a chosen magnitude could be captured and slowly released into the wetland over time. This would necessitate a storage reservoir in addition to the space for a wetland. The design storm for capture and release/treatment in NMR is a variable limited by the space available. The potential area for this is in the southern end of Frick Park. Due to the high input concentrations of fecal coliform bacteria associated with storm flows, a wetland would not render the water fit for human contact under DEP regulations. Also, as long as there are authorized CSOs directly downstream of the potential wetland area, the overall benefits to water quality would be limited. Therefore, a wetland to treat captured storm flows in NMR should not be considered before an SSO/CSO mitigation plan is developed.

VII-h. Site-Based Infiltration in the Upper Watershed (Map VII-h)

Traditionally, American cities have employed a “send it away” approach to stormwater management. Any precipitation not needed to water lawns and plants was considered a nuisance, something to be poured off roofs, parking lots, and streets, funneled into pipes and concrete channels, and carried off and dumped someplace—usually a stream or river few paid much attention to—where it would not interfere with daily life. City planners and engineers built enormous networks of storm sewers and combined sewers to send away the water running off the many impervious surfaces in the cityscape. The Nine Mile Run watershed is typical of many urban watersheds in these respects.

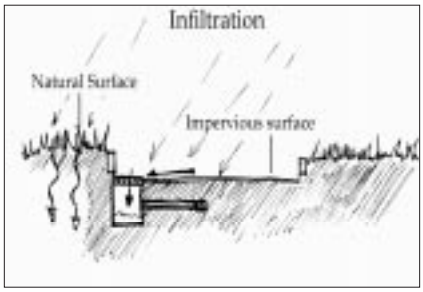
Community Input

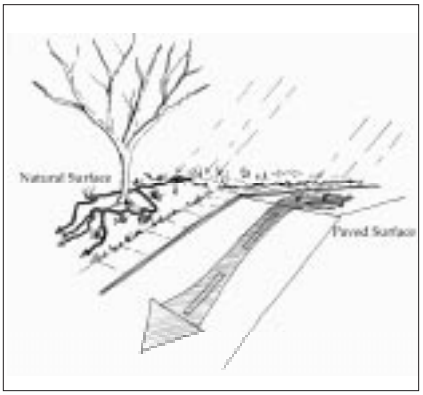
John Smith: All this discussion is concentrating on sanitary sewer issues. How about stormwater? Roofs and streets rush water into that stream—we are forgetting that what has been used as an open storm sewer is a living thing.

Today, around the country, water experts and city residents alike are beginning to outline a better approach for managing the water falling on our cities. This alternative paradigm has several components. First, we are recognizing the impacts of stormwater on the receiving waters. Large pulses of runoff scour and degrade stream channels, and oil, dirt, dog feces, and other contaminants carried by urban runoff degrade water quality downstream. Second, we are coming to see rainwater and melting snow as a resource that can be put to use to increase the beauty and functionality of our cities; for instance, these sources can be used to water new trees that help clean the air and shade our streets and buildings. Third, we are discovering many ways to handle precipitation more naturally. One way is to absorb it where it falls and then release it slowly, as nature does. Landscape architect Bruce Ferguson says it best: "Water belongs in the soil."

The guiding principle of this new approach is to start the use and management of each drop of precipitation as close to where it falls as is technically possible and economically feasible. This means examining the options available at the scale of individual buildings, yards, parks, streets, and neighborhoods. Some of the measures that have worked in other communities and could be considered here include:

- Tree plantings. Studies have shown that tree foliage can hold and absorb or evaporate up to 35 percent of the rain falling annually on the diameter of the tree canopy.
- Turf management. Aeration and other techniques can increase the infiltration rate of lawns. Certain grass species, by virtue of denser, deeper roots, can further improve infiltration.
- Roof leader disconnects. Removing rain leaders from sewers seems an obvious step to cut stormwater volumes in combined or separated lines, but what then happens to the roof runoff? Appropriate redirection of the leaders, re-grading of the landscape around a building, use of dry wells (constructed infiltration chambers), and other techniques can infiltrate roof runoff without flooding basements.
- Cisterns. Some roof runoff can be captured in rain barrels or other cisterns and either used for yard and garden watering, or released to dry wells or other infiltration systems once the storm passes.
- Surface infiltration basins. In some yards and many commercial landscapes, ponds, temporal "water gardens," and other basins can be designed to gather site runoff and hold/infiltrate it over varying periods of time.
- Driveway "cuts." Modifying driveways to increase pervious area can be done in many ways.
- Street narrowing. Common now in new developments, narrow streets calm traffic, increase green space, improve property values, and reduce impervious area. Some American communities are narrowing existing streets for the multiple benefits created. Portland, Oregon calls its effort the "Skinny Streets" program.
- Parking lot redesign. Creative layout can incorporate "infiltration islands," filter strips, and other stormwater management features with no or little impact on the number of parking spaces.
- Porous pavements. The techniques are well-developed and the





performance well-tested. As streets and parking areas are re-paved in coming decades, porous paving options should be given strong consideration.

• Subsurface detention/infiltration chambers. Made of gravel or manufactured components, varying depths and capacities of chambers can be installed under lawns and parking lots to hold large volumes of site runoff during a storm and infiltrate that water to the subsoil in the following hours or days.

• Eco-roofs. A modern variant on the sod roof, with lower weight and easier handling and maintenance, has been created and installed widely in Europe. Eco-roofs absorb water and evaporate it back to the air or grow incorporated plants, greening and cooling the cityscape.

Benefits of this Approach

The possible benefits, economic, aesthetic, and environmental, of small-scale infiltration/detention approach are many. Naturally they depend on the measures used, local hydrology, problems addressed, and costs and nature of alternative approaches. Here are some ways residents, businesses, and governments in the NMR watershed might benefit from implementing these sorts of measures:

• Reducing stormwater volumes in combined sewer lines. This approach could save money by freeing up capacity in existing lines, perhaps avoiding costly separation of sewer and stormwater flows in some parts of the watershed.

• Similarly, reduced stormwater volumes could allow for *in-situ* lining of sewer lines, or downsizing of pipes where new lines must be installed or old ones replaced.

• EPA is likely to ratchet-up regulations on the water quality impacts of stormwater runoff in the future. Many of these measures provide treatment benefits (soils, their micro-organisms, and plants absorb, break-down, take-up or otherwise neutralize many pollutants) and will help local communities address water quality.

• This approach can help reduce high flows, and provide recharge to augment low flows in NMR. Moving towards a more natural stream flow regime will improve the chances of success of the stream restoration efforts envisioned by many local residents for Frick Park.

• Many of these measures will improve the landscaping of area homes and businesses, increasing property values.

• By literally “greening” local landscapes, yard-by-yard and neighborhood-by-neighborhood, these measures can produce tangible benefits such as reducing the energy load created by unshaded pavement and buildings. And they will produce the less tangible psychological benefits of a greener cityscape.

VII-i. Watershed Management, Integrating Infrastructure with Ecology

Urban watersheds have traditionally been managed as infrastructure systems, ignoring the underlying ecosystems which have been often displaced and always affected. The Federal Clean Water Act and the Pennsylvania Clean Streams Law have instigated regulatory agencies (Pennsylvania Department of Environmental Protection and Allegheny

County Health Department) to maintain water quality standards at the "receiving body of water". This has typically been accomplished through the regulation of point source discharges and related enforcment actions. Typically, such action has resulted in expensive detention projects or watershed authorities who concentrate on an isolated length of trunk sewer line (local examples include Falls Run and Girty's Run). An integrated watershed authority mandated to monitor and protect the stream ecosystem through chemical and biological analysis would provide a more equitable gauge of infrastructure function efficacy than the existing model. Urban ecosystems may prove to require a more vigilant analysis than suburban and rural systems. An integrated watershed authority with the ability to monitor and protect the stream ecosystem and maintain the infrastructure would connect the cause and effect of urban watershed degradation. We will outline a number of options for creating a multi-municipal watershed authority and its potential to integrate ecosystem and infrastructure in its management mission.

Community Input

Alex Hutchinson (Edgewood Borough Engineer): If 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.

The overall goals of a NMR Watershed management structure are:

1. Equitably eliminate existing sewage pollution and slag leachate problem.
2. Explore options to minimize stormwater damage and pollution.
3. Restore and steward the ecosystem functions in the watershed.
4. Manage the infrastructure and ecosystem to maximize benefits and minimize costs.
5. See the greenway built and managed as a watershed resource.

In 1997, Don Berman outlined the reasons why govenments should cooperate. First, ecological and infrastructure systems are not confined to municipal boundaries in either form or function. Multi-municipal agreements which enable a geographical (watershed) approach ensure that the problem is integrated in definition and integrated in solution. Second, economies of scale become evident in cooperative management programs. Multi-municipal initiatives can increase purchasing power and reduce costs through bulk purchasing. Personnel costs can be leveraged in terms of mitigated inspection overlap, consistent integrated problem solutions, and employee job pride. Larger projects can bring a multi-municipal personnel approach with shared costs and access to more equipment. Third, many grants and low-interest loan programs now give priority points to multi-municipal projects.

While the cooperative management of a watershed would seem to be a logical solution to stormwater and sanitary waste transport problems, a report on stormwater management for Allegheny County clearly states: "Coordinated stormwater management will be difficult to achieve if left to voluntary municipal cooperation." (Coopers & Lybrand, 1988).

Looking to ecosystems for indication of water quality and pollutants is an accepted monitoring practice. Benthic organisms in particular have been used since the 1900s as indicators of water quality/water pollution (Mirani). Protocol for benthic water quality analysis is recognized by the

Community Input

Kathy Stadterman: Are there any options for developing a watershed wide authority?

AB Carl: Several types of watershed authorities and associations have been formed in the region. The Turtle Creek Watershed Association has a volunteer citizens organization that focuses on the use of the stream for fishing.

John Schombert: Girty's Run in the North Hills is an example. They are an authority with the option to go take out loans to solve problems.

Ken Johnson: Do authorities work with volunteers or appointed personnel?

EPA and the State Department of Environmental Protection. The water quality study by Dzombak and Lambert (Appendix VII-E) for this report identifies specific discharge points as well as changes in water quality over the length of the stream. An understanding of the physical infrastructure coupled with an evolving ecosystem analysis of biotic and abiotic components of NMR will provide a good baseline from which to identify indicator species and physical components of the ecosystem for monitoring.

The rationale for monitoring an ecosystem to manage sewage and wastewater infrastructure is both good science and good public relations. Biological monitoring is easily communicated to the population that will be actively using NMR. Populations of insects, plants or fish are either there/or not there—healthy/or not healhy—taking some of the guesswork out of maintaining water quality in an urban stream. If a watershed authority is required to regularly monitor ecosystem function and water quality in receiving waters (with a strict protocol) then regulatory agencies can test the veracity of the management program with spot checks and comparisons. A site-specific public program of biological monitoring (see Section VII-J Enhancement) can provide the public with some general observational tools which will allow them to develop a deeper understanding of water quality and ecosystem relationships.

The multiplicity of municipal and regulatory interests in NMR complicate the resolution of problems because of a lack of understanding of who is responsible for what and the problem of regulating a system which has artificial boundaries upstream from the effects of the problems. For instance, the upstream municipalities have responsibility for the collection and transport of sanitary waste and stormwater from their municipal boundaries to the general region of Frick Park, where stormwater emerges into the stream, and sanitary waste is merged in a trunk sewer which is under the control of Pittsburgh Sewer and Water.

Stormwater emerging from the culverts and stormwater pipes serving the following upstream municipalities has been rigorously documented as pathogen impacted, although the exact source(s) of the problem have not been identified. It is suspected that illegal tie-ins of sanitary lines to the storm sewer, leaking adjacent sanitary lines, and other problems are affecting NMR water quality. (See Section IV-E Water Quality, see Appendix IV-E for the full report.) The following municipalities maintain their sewer systems through their individual departments of public works. Management of the systems and major maintenance is handled through contracts with private engineering firms. Wilkinsburg and Swissvale share the same engineer.

The culvert at Braddock Avenue during a stormflow.

- Wilkinsburg - Public Works Department — Maintenance of Wilkinsburg's separated storm and sanitary sewers until they reach Nine Mile Run and the trunk sewer, respectively.
- Swissvale - Public Works Department — Maintenance of Swissvale's separated storm and sanitary sewers until they reach Nine Mile Run and the trunk sewer, respectively.
- Edgewood - Public Works Department — Maintenance of Edgewood's separated storm and sanitary sewers until they reach Nine Mile Run

and the trunk sewer, respectively.

• The Pittsburgh Water and Sewer Authority — Maintenance of the city's combined sewer system and the trunk sewer extending through the valley to the Allegheny County Sanitary Authority interceptor near the Monongahela River. Pittsburgh has one CSO which discharges into the upper watershed culvert. Pittsburgh is primarily responsible for both Frick Park and the NMR development site as well as the trunk sewer used by Wilkinsburg, Swissvale, and Edgewood to transport sanitary waste to the Allegheny County Sanitary Authority (ALCOSAN) Interceptor at the mouth of NMR, near Duck Hollow. The city of Pittsburgh has four CSO outfalls on NMR. A recent performance audit indicates that Swissvale is the only municipality signed to a maintenance agreement on the NMR Trunk Sewer (Flaherty, 1998). A maintenance study by Chester Environmental indicated serious problems in the trunk sewer, allowing sanitary waste to discharge into the NMR water table, and consequently into the stream itself.

• City of Pittsburgh - Public Works Department — The City Public Works Department is responsible for maintaining Frick Park. The Public Works Department's Construction Division is responsible for new construction.

• City of Pittsburgh - Department of Parks and Recreation — Programming and planning for Frick Park. The Department of Parks and Recreation has been unable to affect the 90-year history of sanitary effluent/public health hazards, infrastructure failure, and a compromised riparian ecosystem.

• The Department of City Planning — Is responsible for new planning for city parks. It has taken an avid interest in water quality and ecosystem improvement in NMR.

• Urban Redevelopment Authority — Landowner of 235 acres in the lower watershed, through which Nine Mile Run flows.

The following agencies have responsibilities that transcend municipal boundaries. They are designed to resolve regional problems and protect public health and environmental quality.

• Allegheny County Sanitary Authority(ALCOSAN) Maintenance of the interceptor sewer near the Monongahela River. ALCOSAN's official responsibilities go no further than their collection point in Duck Hollow. Despite this, they have taken an active interest in NMR, working with the municipalities and providing support for onsite analysis of the problem. ALCOSAN has also helped initiate and coordinate with the Health Department on the Wet Weather Demonstration Project, which will help municipalities to address sewer overflows.

• Allegheny County Health Department — Regulatory agency with authority to enforce Pennsylvania's Clean Streams Law and the Federal Clean Water Act. The Health Department and ALCOSAN initiated and are coordinating the federally funded Wet Weather Demonstration Project to help municipalities address sewer overflows.

The current "best solution" to NMR water quality problems.

Community Input

Jim De Angelis: Has the State or County told the municipalities that they will be needing to resolve the dry weather problems?

• Department of Environmental Protection — A State regulatory agency with authority to enforce Pennsylvania's Clean Streams Law and the Federal Clean Water Act.

In summation, the NMR watershed agencies and communities are infrastructure focused, with little attention paid to the cause and effect of the infrastructure and its dysfunction on the ecosystem which defines the “receiving stream.” Pittsburgh City Parks and the DEP are the most likely agencies to take an interest in the conditions of urban infrastructure. DEP’s interests are statewide and focused on more pristine environments rather than historic urban problems. The Pittsburgh City Parks Department is interested, but not enabled politically or financially to act on the problem.

Multi-Municipal Watershed Approaches

Local governments have the legal authority through existing legislation to enter into an agreement, a contract, or an environmental compact. In fact, the Allegheny County Health Department has recently issued new Sewage Disposal Regulations which require “municipal management and cooperation of sewage management between municipalities.” (Section 1401 of the Allegheny County Health Department Rules and Regulations). The organizational structure is up to the participating municipalities.

In 1988, the Allegheny County Planning Department and Coopers & Lybrand completed a stormwater management study which addressed a watershed approach to management. The study reviewed eight institutional alternatives legally available in the Commonwealth of Pennsylvania. The institutional alternatives relevant to Nine Mile Run are:

Joint Municipal Authority — Two or more municipalities agree to operate jointly an authority with the capacity to own, construct, and operate facilities, sell revenue bonds, set fees, and perform other related services under contract to the municipalities. The legal authorization for such an alternative is the Municipality Authorities Act of 1945, 53 Pa. C.S. Sec. 301, et seq.

Allegheny County Sanitary Authority — Expand the management powers of ALCOSAN, a joint municipal authority incorporated under the Municipal Authorities Act described above, to include stormwater management and the municipal sewer lines. The ALCOSAN Board would have to agree to expand its responsibilities and each municipality would have to pass an ordinance to join for that purpose.

Environmental Improvement Compact — An environmental improvement compact, authorized by the Pennsylvania Environmental Compact Act, is formed when two or more municipalities join together and enter into an agreement to allocate municipal functions to a new political body, governed by elected officials and having jurisdiction over all participating municipalities. The citizens of each municipality must authorize such participation through initiative and referendum.

Stormwater District — A stormwater district would require enabling state legislation, but it would have the power to tax, charge fees, and sell bonds.

Contract with a Private Entity — Municipalities contract individually or jointly with a private entity capable of performing some watershed functions. Responsibility for implementation and the powers of enforcement continue to reside with the municipalities.

Management Committee — Municipalities agree to share in the costs and responsibilities of upgrading and maintaining a shared resource. Each municipality must enact legislation authorizing the agreement. This is an informal approach not considered by the Coopers & Lybrand study.

Criteria for rating management options for Nine Mile Run should include:
(1) the ease with which the organization could be implemented by the municipalities within the watershed;
(2) the degree to which the organization will be able to enforce compliance with applicable standards and criteria;
(3) the extent to which the organization promotes democratic participation and the representation of the constituent municipalities and local citizens;
(4) the ease with which it will be able to finance the activities necessary to achieve the goals for the watershed, either through user fees, bonds, or taxes;
(5) the extent to which the organization links infrastructure improvement and ecosystem function; and
(6) the authority it has to bind the municipalities.

When management fails. Citizens can respond to a lack of management and regulatory inertia. Citizens who live along a stream and feel that they are being negatively affected by upstream water problems have various opportunities to pursue legal action. After years of discussion and unfulfilled calls for mapping, assessment, and management planning, a group of individuals in Regent Square are currently exploring their legal options as citizens to force the issue and encourage the municipalities and the regulatory agencies to take action on the chronic sewage which affects NMR.

See the Appendix for Case Studies in Multi-Municipal Watershed Approaches.

Community Input

Uzair Shamsi (Chester Engineering, author of the Trunk Sewer Study): Privatization of CSO treatment should be considered.

- Perhaps a compony from Pittsburgh is interested in operating a treatment plant

- cited case studies in Atlanta and a 20-yr contract for managing CSOs near Boston

Jim De Angelis: Raising issues and public awareness does NOT effect the stream. The municipalities will not decide to act unless compelled to act. Provide the information to compel action or admit defeat and dissolve this process.

VII-j. Enhancement (Map VII-j)

One year ago, enhancing Nine Mile Run included the option of culverting it. Culverting urban streams has been the preferred practice in American cities for over 100 years. Culverting as a historic solution to water problems can be described as an application of

Samuel P. Hayes, a Professor Emeritus at the University of Pittsburgh, outlines the evolution of environmental thinking in his book *Explorations in Environmental History*:

1) Environmental conservation as best use with an interest in efficient production. This is typified locally by the Army Corps of Engineers early work on the rivers. Dams, locks, and controlled release of water enables the efficient use of the Monongahela, Allegheny, and the Ohio for transportation, drinking water intake, and flood control.

2) Environmental preservation, the protection of lands from commercial development or production in order to enjoy them for their natural beauty. This approach is best illustrated on the state and federal level by national and state parks and on the local level by the Western Pennsylvania Conservancy.

3) Environment as the context for quality life experiences. This is an emerging set of values which are qualitative. A search for a better standard of living which focuses on surroundings which can be perceived as either more pleasant or more degraded.

science and technology in such a way that it would eliminate waste (undevelopable land), manage urban problems (stormwater problems exacerbated by paving and poorly maintained sanitary sewers), and enable production (development). Turning vacant valleys and wetlands into attractive parcels for urban development was part of the ideal of a value system which was based in human production. The relative value of the environment as context for the meaning of "quality of life" was rarely considered. Quality of life, at that time, was defined by cultural constructs—the product of human labor enabled by the raw material of nature. Quality of life has shifted away from cultural constructs and toward environmental interests since the days of industrial dominance of Pittsburgh's waterfronts.

Today, culverting has fallen out of favor with regulators and communities alike. Here in Allegheny County, John Shombert, Chief of the Water and Waste Division of County Health, has said publicly, "I can give you 20 reasons why culverting is a bad idea." In private conversations he has described culverting as the "out of sight, out of mind approach," whereby municipalities often ignore their water problems and regulatory agencies must make incredible efforts to pinpont problems to bring any enforcement action. Communities from Cleveland, Ohio and Montgomery County, Maryland to Berkeley, California have taken their urban streams to heart, recognizing the quality of life enhancements which an urban stream can bring to an urban experience. There are a number of national organizations that have taken urban streams as their focus including the Center for Restoration of Urban Watersheds (CRUW). American Rivers has its own urban streams program and the Izaak Walton League has created numerous texts to enable citizens to not only monitor their streams but begin to plan for their recovery.

With this document, we begin a process of public involvement to enhance Nine Mile Run—to celebrate it, its place and its community of people, their attendant homes, the wildlife that populate its open spaces, and the habitat they depend upon. In the preceding pages, the team has worked to outline an approach to a river corridor which will shift a 90-year paradigm of tragic abuse. The remnant ecosystem has been carefully analyzed in sections on land and biological resources; the infrastructure has been analyzed in the section on water resources. Previously in this section, the team has outlined approaches to revegetation, restoration, and sustainable practices on an urban watershed. After conducting a case study of existing watershed models, the relationships between the natural ecology and the ecology of the infrastructure have been integrated and a proposal made for a watershed authority which transcends existing models. The community has offered input on these concepts, methods, and approaches, expressing dismay and anger at the history of problems, defended existing amenities (the lower Frick Park ballfield), and rallied around the opportunities for change.

Samuel Hayes has said, ***"One of the major political tasks of the present day is to lay bare the value implications of planning so that the public can understand the choices that are being suggested and make intelligent decisions about them."***

There is an emerging interest in the environment as the context for quality life experiences. Planning for the future is a value-based exercise which can be informed by history and the knowledge of experts, but must ultimately be integrated with community interests and active citizens to have any effect. Over the last 100 years, Pittsburgh's environmental values have shifted radically, from the use of the environment as source, context, and sink (Tarr, 1984) for industrial production to the environment as context for living. Defining the environmental values (and by extension the enhancement options) of post-industrial cities will be an ongoing process. This watershed dominated at its mouth by a brownfield site is a new context for a model of river conservation planning, a new way to think about places which have been abandoned. NMR has been stripped of its natural characteristics then allowed to lie fallow, recovering on its own, with humans and wildlife reentering, rediscovering the use-value of this property. This River Conservation Plan is essentially a tool to devine the relative values of urban watershed restoration (quality of life goals) and how they should apply to the changes which will occur in and around the NMR watershed. There are many difficult and exciting choices ahead and this plan is only the beginning.

Seven percent of the land in America is classified as urban, but this is where 74% of the population lives, works, and plays. Urban streams are amongst the most degraded streams in the country.

Bruce K. Ferguson
in *Introduction to Stormwater*

If we are going to enhance an urban watershed, quality of life must be a priority goal. That quality of life has to be achieved in the context of economic equity and long-term sustainability. This goal is not going to be easy to achieve.

The first approach to the challenge of enhancement is found in knowing the place again. Recent trips to the top of the watershed by the NMR-DCNR River Conservation Team found unculverted sections and a spring-fed creek, with benthic organisms only present in clean streams. The ongoing analysis of the lower watershed indicates a remarkably resilient urban ecosystem with potent pockets of biodiversity. Even the NMR slag dump has illustrated a remarkable potential for regeneration; we must experience the watershed and its component places to understand the opportunities as well as the problems. So, the first method of enhancement will be defined as familiarity with our watershed.

NMR is an urban stream which flows from an urban valley where it is joined by the remnants of a spring in an urban park. It then flows into a post-industrial slag dump and empties into a larger river, which is still defined for its use as an industrial waterway by the Port of Pittsburgh. The Monongahela is one of the defining bodies of the Three Rivers region and a definitive focus of future economic growth and quality of life planning. At the same time, this river is being targeted as the location of a major new highway and its banks being touted for industrial, commercial, and residential housing. Clearly, the future of Pittsburgh's urban streams and rivers will be conflicted by interests which range from the historic/industrial to the economic and environmental point of view. The answers to these conflicting interests will be found in the process of democratic discourse. It is clear that if we are to achieve the goals of this plan - regenerating ecosystem

functions and establishing the value of natural experience and ongoing education at NMR - it will be essential to marshall creative resources. Let us consider this the second method of enhancement, creativity.

Since the decision to leave Nine Mile Run unculverted has been made, it means that enhancement has taken on a new and more serious public meaning. No longer is it an issue to be dealt with by a private developer. Instead it has become a point of convergence for communities and citizens to rally around with the goal of seeking resolution for a problem which has persisted for well over a century. The sustainable creation, development, and maintenance of a greenway extension at NMR will take many individuals with an "invested interest" in the creation of such an amenity. In many ways this community of stewards who will restore the public function and value of the NMR greenway will need to mirror the "invested interests" of the private industries that created a dump at NMR. The third method of enhancement, is stewardship.

In the following paragraphs we will expand upon the methods of urban stream enhancement: (1) familiarity, (2) creativity, and (3) stewardship. Then we finish the section with some specific recommendations which came out of the community planning process.

VII-j1. Watershed Familiarity and Urban Stream Appreciation

How do we share the concepts, experiences, and ideas of watershed appreciation? Urban areas are full of problems and issues which often overwhelm the most nimble urban minds. The question that we must address is how do we link emotions and experience of the opportunity with the intellectual/cognitive analysis of problems? If we are going to motivate an emerging appreciation for urban streams, we must rely on pleasurable experiences, personal memories, and a shared history to build the motivation to change.

How do we link the experience of trash at the mouth of NMR with the economics of street cleaning in the upper watershed? How do we link the effect of 500 roof drains on the erosion occurring along the ballpark in lower Frick Park? How do we connect a history of cheap sewer rates with a degraded urban stream? How do we connect the needs of the steel industry in 1924 with the aesthetic and ecological challenge of 1998? If we are to enhance the NMR watershed and its streams, we must understand its current condition. Citizens, students, teachers, politicians, and municipal officials need to be introduced to the place, its wonders as well as its problems. It needs to become a subject of conversation amongst diverse communities, in the schools and in the homes. We need to create opportunities to be along the stream, then forums for discussion, then the political will to understand the problems and address them. Throughout this process we need to welcome all users to the table as we discuss the ways to improve, maintain, and sustain this urban resource.

Without both experience of the opportunity and an understanding of the issues, no change can occur.

Ted Floyd
When I first started birding in Frick Park, as a teenager, I was mesmermized by the great abundance and diversity of warblers that would stream through the park every spring. But I also assumed that similar spectacles were staged in every comparable forest fragment throughout the region. I have since learned that, to the contrary, Frick Park is exceptional, and nearly unique, in comparison with comparable forest tracts in the region.

"I know of no safe depository of the ultimate powers of society but the people themselves; and if we think them not enlightened enough to exercise their control with a wholesome discretion, the remedy is not to take it from them, but to inform their discretion by education."
Thomas Jefferson

VII-j1a. Access

Access is a key issue. If we can't approach a place, it is hard to appreciate it.

• Nine Mile Run is an accessible urban stream - by the simple fact that a significant part of it is not underground in culvert! (All of the other urban streams in Pittsburgh between the Monongahela River and the Allegheny River have been culverted.) Furthermore, the spring-fed creeks in Frick Park are still flowing, and the valley will soon become a continuous public greenway with public access to NMR corridor from source to mouth.

• The streambed, however, is not that accessible. Erosive downcutting of the banks provides a physical barrier to anyone who actually wants to "touch" the water. This is further complicated by water quality which is so bad that the Allegheny County Health Authority considers it a health hazard.

• The riparian corridor, the floodplain, and banks along the river are accessible from the sources in Frick Park to the mouth at the Monongahela and at numerous points through the watershed communities. (The trail system being discussed along the busway in Edgewood and into Wilkinsburg would be an important link into the valley.) Access in and through the valley is relatively good and has been illustrated and confirmed as an important benefit at a number of community meetings. It is important to recognize the valley as not only a destination but as an alternative transport corridor, linking hikers and bikers from the interior watershed to the Steel Heritage trails upstream and the Three Rivers Heritage Trail downstream.

• Access from the Monongahela River would be a unique and educational experience. Docking facilities could be constructed at either the site of the old Homestead Bridge or between Duck Hollow and Greenwood where Duquesne Slag once offloaded its barges. Organizations like the Pittsburgh Voyager could be encouraged to explore the urban stream and its relationship to the river.

NOTE: The nomination of the Monongahela as a modified recreational river, to be placed on the Pennsylvania Scenic Rivers Inventory, is an important goal. This would be a likely point of interface with the Steel Heritage Foundation which sponsored the Monongahela River Conservation Plan and is a likely sponsor for the nomination.

VII-j1b. Education

Education can occur at many levels and across many communities. Specific grade-school models already exist in various communities of the watershed. The Regent Square School has developed an innovative environmental program with the Frick Environmental Center which integrates adjacent Frick Park and its ecosystems directly into a grade school curriculum. The STUDIO for Creative Inquiry began a program of adult "dialogues" about various aspects and issues of the development of post-industrial (brownfield) open space along the NMR corridor. This program focused on four issues: (1) history and public policy, (2) stream remediation, (3) community and ecology, (4) sustainable open space. These issues are replicated in a childrens' education program which takes an integrated inquiry-based method of

art and science, to explore ecological and social ecosystems. This program was initially developed in the Homewood Montesorri School and has been/will be presented in other schools throughout the watershed. The Carnegie Museum of Natural History has begun a "Bioblitz" program whereby a team of scientists quantify biological diversity in a 24-hour period in the city parks. This program builds a coalition of environmental and educational organizations with the express intent of teaching the value of biodiversity through a mix of onsite experience and accessible scientific analysis. The data collection and web site which emerge from this event provide an evolving reference and eventual standard for ecosystem function in urban and post-industrial environments. While, the Carnegie Museum of Natural History has the collection and expertise to eventually produce a definitive book on natural systems and urban change, other cities are far ahead of us. New York City has a book on natural systems and urban context originally published in 1959!

VII-j1c. Maps

Maps are wonderful tools to help us understand our relationships to places. Census maps can illustrate the economic and social mix of a community; topographical maps tell us about landforms; habitat maps can tell us about plant and soil relationships; road maps get us where we are going. Many different kinds of maps are being created as part of expanding computerized mapping capabilities (GIS, or Geographical Information Systems). There are existing movements to interrelate some of these maps for a variety of public uses. Road maps which express green features (**green maps)** and neighborhood maps which clearly express trail connections, diverse habitat, and sites for a variety of "**wild-in-the-city**" types of experiences can be (and are being) easily constructed. The County Health Department has constructed rigorous engineering maps of the watershed and its sewer infrastructure, making these data sets available to municipal government and maintenance crews in the watershed. Variations on this type of information could be provided to the general public to help them "see" the complexity of the system and the interconnections which make municipal management/regulation and enforcement such a challenge.

Green Map
An idea currently being explored by a consortium of environmental interests in Pittsburgh. The "Green Map" committee consists of representatives from The National Aviary in Pittsburgh, Friends of the Riverfront, The Environmental City Network, Rachel Carson Homestead, Earth Day Network, The Group Against Smog and Pollution.

Wild In the City
This is a concept that has been used in a number of the larger cities. San Francisco has a "wild in the city" map created over ten years ago.

With the opportunities for electronic publishing, these map options are low-cost variations of the traditional data sets which municipal managers, park and recreation managers, and roadway crews must produce anyway. GIS data/maps can be distributed either through the World Wide Web (and printed out with Adobe PDF files) or with an Internet extension to the commonly used Arc-Info GIS mapping software. Translating management tools into public information tools is increasingly cost-effective and helpful in building a knowledgeable constituency of watershed residents.

VII-j2. Creativity

Creativity is often misunderstood as the sole purview of the arts and humanities. If we are to achieve change and resolution of problems at NMR we will need to look towards innovative and creative ideas in a number of disciplines which address land, water, infrastructure, and

policy. We also need creative action from the people who live in the surrounding watershed and its component communities.

Because the NMR watershed has a “reversed” environmental equity issue (i.e., the community at the highest point in the watershed is the most economically challenged while the communities which will extract the most direct benefit—by being adjacent to the stream valley—are economically stable), the “solution” to NMR urban water problems and environmental equity may be found in an analysis of capacities and assets of the upstream municipalities. This asset analysis approach is presented by social theorist, John McKnight, who also cautions that in the resolution of public problems, agencies and regulators should be guided to “do no harm” to communities. This analysis technique has complimentary models in landscape architecture where Ian McHarg has outlined an approach to design which is based in the analysis of ecosystem assets and constraints as the context for landscape design and planning, and in the arts where Robert Irwin has outlined an analysis of experiential phenomena as a foundation of site determined art, or phenomenological art, where the viewer is cast in the same role of aesthetic discovery as the artist. Each of these diverse yet similar models have the potential to cast the community and its citizens in an active rather than passive role. These approaches can enable discussion and promote a perception of capability, responsibility, and creative action.

> Creativity is a synthesis of matter, space, and time. Creation is not a reproduction of observed fact. The encompassing creative mind knows no boundaries.
>
> a paraphrase of ideas on creativity by Hans Hoffman

VII-j2a. Interpreting the Nature/Culture Heritage

Interpreting the nature/culture heritage means examining this urban stream valley as a unique landscape composed of natural and cultural components. Nine Mile Run is a floodplain buried under 15 stories of steel mill slag. There are two potential approaches to this unique problem: (1) make every effort to grade, vegetate, and mask the viewer from the foundation of slag which this park will be built upon, or (2) accept the slag as part of the cultural heritage of the industrial era and develop specific sites to reveal its properties. Part of the creative challenge of NMR is to rethink the meaning, form, and function of ecosystems within the post-industrial context of political/economic needs, realistic chemical and biological constraints, and the evolution of the surrounding community's aesthetic for restoration.

The experience of NMR is complicated by a mix of natural and cultural phenomena. Part of the dissonance (and energy) of the site can be found in the conflicting thresholds of experience that you move through as you walk the site. Simply put, as you wander along this urban stream you will encounter different materials and components of experience. The Nine Mile Run river corridor has a complexity of overlaying natural and cultural experiences (trees, leaves, grassland, trail, wetland, stream bed, sewer line, concrete channel, trash, freeway, slag mountain). Nine Mile Run also has a complexity of overlaying phenomenological experience, a concept outlined below (adapted from Arnold Berleant, *Aesthetic Perception in Environmental Design*).

Phenomenological Experience of Landscape

	Panoramic Experience	Immersive/Participatory Experience
Definition	A view of the landscape, often without an opportunity to enter (example: scenic overviews, looking at the forest).	An experience of the landscape, where the viewer and the landscape share the same space (example: being "in" the forest).
Intellectual analysis	Space and landscape as an abstract image, intellectual and visual separation between the viewer and the "object" of contemplation.	Space and landscape in relationship to the viewer. Intellectual and sensual immersion in the fabric of the experience.
Experiential analysis	Intellectual/visual response to monumentality, symmetry, geometric balance, and visual harmony (formal considerations).	Physical/sensual response to mass, texture, spatial changes, movement and time in relationship to the viewer (systemic considerations).

At this juncture in time the NMR riparian corridor is defined by the conflicting effects of urban infrastructure upon a remnant/emergent nature. We will never alter the components of this relationship, so the challenge is how to "tune" the experience of this place in such a way that these experiences are clarified and the boundaries of conflicting experiences are revealed. In the attached **Map VII-j2a** we identify specific sites which should be considered as part of the design process.

Examples: Nine Mile Run is always going to have a trunk sewer line running along and in the stream bed. How can the reconstruction that will occur on some of these lines be leveraged to enable access along the stream? Can the cast concrete trunk line be utilized as a support for a pedestrian walkway? (This is an approach used in the Golden Gate Recreational Area's Headlands Park in San Francisco.) Can we replicate the wide deck (no handrail) stream bridge platforms used in downtown Denver on the Platte River trails to subsume the visual effect of sewer line crossings and provide access to both sides of the stream in the process? (This design allows for relatively unimpeded storm flow.)

Public Art

"Public Art is expressing in a creative act the relationship between people and the place where they live. Public art can be an avenue for promoting and expressing commonalities as well as differences. Public art is a social art. It requires the enthusiasm, cooperation, and creative contributions of many people. The public artist is, by definition, a social interpreter, aesthetically sophisticated, skilled in articulating and responding to the relationship between things, people, and places. The

All science should be scholarly, but not all scholarship can be rigorously scientific. The terrae incognitae of the periphery contain fertile ground awaiting cultivation with the tools and in the spirit of the humanities.

John Kirtland Wright

process of making public art invites participants to think critically and creatively. It asks people to respond to a particular place and set of circumstances in ways they may not have done before. It provides an opportunity for people to recover the history of the place where they live, to influence the appearance of their neighborhoods and city. It enables people to participate in the public and political sphere. And in doing so, it promotes civic virtue and deepens the liveliness and sophistication of social discourse. Public art seeks to infuse the social landscape with opportunities for aesthetic involvement, and to increase the community's feeling of ownership and investment in the public domain."

Public Art can stimulate dialogue, not just between the artist and the public, but a dialogue in the broadest sense: between the public and city government, between people who live and work in the area, between the recreational users and the businessmen who invest in nearby properties and businesses. This discussion can be extended conceptually to include the relationship between the individual and the water in the stream, the surrounding wildlife, and the diverse experiences of urban streams.

For the sake of this document it is probably important to state that public art is not constrained to large steel sculpture or works in bronze, stone or other "permanent" materials. The arts and humanities have taken an active role in the restoration of water, land, and societal values affected by industrial processes. This statement assumes restoration to be an integrated process of restoring physical function and societal value to properties long abandoned, ignored, or avoided due to real or perceived problems. The arts and humanities have created important tools, providing the imagery and stories which motivate people to reconsider the value of the damaged landscapes. Ecologist Michael Soule has said, *"The hypothesis is that if our pedagogy is purely cognitive, our chances of motivating a change in values and behavior are nil. We can't succeed in teaching people biophilia (the love of life), with economic arguments and ecological reasoning alone."*

There is a rich literature addressing damaged landscapes. Ann Spurin has written on urban ecology (*The Granite Garden*). Urban historian Andrew Hurley has recently edited a text on cultural diversity and the urban environment (*Common Fields : An Environmental History of St. Louis*). Various urban projects around the country have pointed to the importance of the arts and humanities as tools to motivate change. Interestingly enough, the arts and humanities councils in various states have been amongst the first to respond to the interest in damaged environments supporting artists, historians, and writers to do work which raised peoples' awareness and understanding of the potential of their damaged environment.

There is a history to the shifting of values related to damaged environments which is not popularly known. In the visual arts, cities like Kent, Washington brought in teams of artists in the late 1970s to consider a variety of post-industrial waste sites. The Kent Arts Commission developed two celebrated projects, one a stormwater

Various books on a social approach to public art:

Joseph Bueys was a seminal practitioner of a form of art he called "social sculpture".

Energy Plan for the Western Man: Joseph Beuys in America
(Writings and interviews with the artist) Compiled by Carin Kuoni, Published by Four Walls Eight Windows NY, NY (1990)

These books provide a good theoretical overview of the issues and artists:

But is it ART?: The Spirit of Art as Activism.
Edited by Nina Felshin.
Published by Bay Press, Seattle (1995)

Mapping the Terrain: New Genre Public Art. Edited by Suzanne Lacy.
Published by Bay Press, Seattle (1995)

The Reenchantment of Art
By Suzi Gablik. Published by Thames and Hudson Ltd., London, England (1991)

Culture in Action (Exhibition Catalog)
Essays by M.J. Jacob, M.Brenson and Eva M. Olson. Published by Bay Press, Seattle (1995)

Two books which provide an overview of artists who work with environmental issues:

Sculpting with the Environment.
(features artists writing on their work)
Edited by Bylai Oakes, Published by Van Nostran Reinhold, NY, NY (1990)

Fragile Ecologies, Contemporary Artists Interpretations and Solutions.
(Exhibition Catalog) By Barbara Matilsky. Published by Rizzoli International Publications, NY, NY. (1992)

Books on the issues of public art:

Art Space and the CIty: Public Art and Urban Futures, By Malcom Miles
Published by Routledge, London, NY (1997)

Spirit Poles and Flying Pigs, Public Art and Cultural Democracy in American Communities, By Erika Doss.
Published by Smithsonian Institution Press, Washington D.C. (1995)

management/summertime amphitheater project by Herbert Bayer, and a desolate commemorative landscape by Robert Morris. Other artists have taken a more systems-based approach to disturbed landscapes from Allan Sonfist who developed a native forest in downtown Manhattan in the early ’70s to Helen and Newton Harrison who did a decades work on lagoons and estuaries. They have more recently been involved in a project which explored the issues on the northwest rainforest/old-growth forest, where they intervened in the logging/no-logging dialectic by outlining the acres lost, then making a work of art which used images and text to present an argument for a restoration/ regeneration approach to the old-growth forest. They are currently working on a river in Eastern Europe. Mel Chen has developed a project with Rufus Chaney, a USDA soil scientist, to explore phytoremediation, or the use of plants to extract contaminants from soils. Chen and Chaney replicated their experiment on three sites in the U.S. and one in Europe. This experimental collaboration in art and science has become a powerful tool to communicate the value of phytoremediation to a broad segment of the population.

Artists shift values. During the last 100 years the focus has been on specific artist’s materials, media, and processes. During the last 30 years artists, like other professionals, have started to peer over the borders of their discipline for new ways to think about the relationship of art to materials, place, and people. Artists are a powerful force for change and for new ways of thinking. The value is not in the solution of problems, but in the expansion of context and the potential to reflect/ affect values that may be otherwise forgotten or missing from a program of utilitarian resolution. Helen and Newton Harrison's analysis of the old-growth forest is a wonderful example; the “problem” was defined by logging interests needing to log, and the environmental interests needing to protect. The solution could be found outside the problem statement in a need for a commitment to “investing” in planting to create the future “old-growth” forests of the northwest.

VII-j3. Stewardship

In “Regenerative Design for Sustainable Development,” Richard Lyle references Daniel Bell’s prediction that conflicts between participatory and hierarchical decision-making processes would characterize the early decades of the post-industrial era. Lyle states: “There are reasons to believe that we are making a transition in both public and private organizational structures from rigid vertical hierarchies to more flexible network-like structures that can facilitate flows of information in all directions.”

The NMR Rivers Conservation Plan and various supporting programs (The Heinz Endowments support of Ample Opportunity, the Army Corps of Engineers consideration of an ecosystem restoration, and the new Three Rivers Wet Weather Demonstration Project) are part of an investment in post-industrial change that is supported by local, state, and private foundation interests. The diverse nature of the interest (and funding) in the post-industrial public realm at NMR has supported an atmosphere of consensus-based planning amongst the local citizens and members of the watershed. The goal of this final section of the

report is to outline a specific program of continued citizen access to planning, management, and long-term stewardship of the ecological, utilitarian, and recreational infrastructure of the Nine Mile Run greenway corridor.

VII-j3a. Keepers Cottage/Ecosystem Monitoring Center

In Section VII-i, we have outlined an approach to the Nine Mile Run watershed which would integrate the cause of upstream infrastructure to downstream ecosystem effects on the ecosystem. The argument is simple and straightforward: if the goal of infrastructure design and maintenance is minimal impact on the receiving waters, then the management of the infrastructure must be integrated with the monitoring of those waters. The method of integration would be a watershed authority that went beyond the regulatory mandate with the long-term intent of managing the watershed to its best possible effect rather than the lowest possible regulatory mandate. While the short-term change in actual water quality may track the regulatory mandate, the long-term benefits of this approach would be found in a watershed management team that has the tools to understand the systemic fluctuations and relationships between weather phenomenon, human/user effect, and infrastructure management. This complex understanding has enormous potential to result in policy, design, construction, and maintenance changes that provide maximum benefit for the least capital investment.

As mentioned earlier, to teach a community to care for the environment and ecosystem is a challenge which must be met by intellectual understanding as well as emotional engagment. Yi-Fu Tuan, speaks of topophilia: *". . .the bond between people and place or setting. Diffuse as a concept, vivid and concrete as personal experience."* Urban infrastructure and its professional class of engineers and managers have created a social phenomenon where the common man on the street has no idea where his sustaining fluids come from or where they go when he's done with them. If we are going to create a facility which integrates infrustructure with ecosystem we must also find a way to engage the emotions and physical senses, to tell the histories of change, the experience of individuals right alongside the data and analysis of the professional and the manager. We need to find creative ways to complicate the topophilia of industrial culture with the diverse and emergent topophilia of today.

To meet the goal of integrated management and post-industrial topophilia, we propose a greenway keepers' cottage and ecosystem monitoring center. The concept is based in the idea of creating a public-access node for ecosystem and infrastructure. From a systems point of view, this would be an architectonic structure which integrates the diverse social needs of an urban greenway and its typical receiving waters with the infrastructure management of an urban watershed. The social goal is to create a site of public understanding, public education, public expression, and public access.

An excerpt from
"The bear who came to town" Published as an editorial in the Pittsburgh Post-Gazette, on Saturday, Jan 11, 1997.

By Brian Connelly

Walking along NMR in Frick Park looking for deer on the last Saturday in December, I noticed the trash bags hanging like prayer flags from the low branches of the trees over the stream. The bags are deposited in the branches when the stream floods after a rain, and the water flows 4 feet over its normal level.

I was looking for that small herd of deer that ekes out an existence between the polluted stream and the parkway, but there was not much chance of seeing the deer, because two young boys were riding bicycles through the muddy track along the stream and making noise. As they both pulled alongside me one asked, "is there bears in Pixsburgh?"

Although the bear was seen heading for Westmoreland County before Christmas, after trekking across the East End from Garfield to Duck Hollow where NMR meets the Monongahela, and then swimming the Mon, he may still be around. In the last few weeks I have overheard a few people telling their kids to watch out for the bear. Maybe the bear will become eternal as an urban legend. I like his presence in whatever form.

The bear's choice of a route through Pittsburgh was interesting. A group called the Nine Mile Run Project are working to create a greenway connecting the Monongahela to the NMR river valley. This is pretty much the bear's route down to the Monongahela.

Already in the East End of Pittsburgh and the near suburbs, more and more deer, hawks and turkeys show up in places where they haven't been common in a hundred years.

Without greenways to link the open spaces, wildlife is trapped in small areas, and this leads to inbred populations surviving on marginal food resources. So now deer regularly eat my Dad's rose bushes in Mt. Lebanon and communities like Bethel Park and Fox Chapel organize hunts to take out the deer that survive in their backyards and show up bewildered on their streets.

The bear followed the nascent greenway to the river because it was there. He probably had an idea where he wanted to go, and green valley bottoms lead to a river. And he could get to the river without crossing any major highways. If he had found himself in Monroeville or along Route 19 in the South Hills, he might not have made it to the river alive.

An outline for a program for this facility:
(1) create a node of monitoring and communication about the lower watershed and its cause and effect relationship with the upper watershed;
(2) create a method of analyzing and documenting the effects of an ongoing watershed maintenance program;
(3) devise a chemical and bio-monitoring program which will provide an early warning system for maintenance problems in the infrastructure (canary in the coal mine);
(4) integrate professional knowledge with community education through programs which complicate the perception and understanding of the urban ecosystem and its biological indicators; and
(5) make the integrated urban ecosystem available for study amongst local schools and universities.

The design of the facility which would include the following elements:
(1) a state-of-the-art, sustainable design integrating utility with regionally relevant creative form;
2) a downstairs laboratory with state-of-the-art lab equipment coupled with an open architectural floor plan for community meetings and discussions; and
3) an upstairs residence, providing a consistent and passive element of security, access, and responsibility for the greenway.

VII-j3b. Inter-Species Nodes and Systems of Reintroductions

As surely as industrial culture and its physical by-products have transformed the Pittsburgh landscape, post-industrial culture has the potential to do the same. As we restore, reclaim, regenerate, revegetate, and heal the watershed ecosystem, we have the potential to reintroduce species. The reintroduction of species has both scientific and cultural validity; it complicates and restores natural diversity while providing imagery and stories which redefine post-industrial nature and culture. Any introduction of animals and plants into the greenway should take place within the context of the restoration approaches discussed in the sections above. Reintroduction of animal species or their specific habitats should be modeled on extant, local communities under controlled conditions. A number of possibilities have been raised to date: osprey platforms near the mouth of the stream; habitat installations for reptiles; nesting structures for songbirds and other migrants. Guidelines for such initiatives should be developed in consultation with groups such as the Carnegie Museum of Natural History, Chatham College, University of Pittsburgh, Penn State University, the Department of Conservation and Natural Resources, and the Federal Fish and Wildlife Service. The involvement of the local community and school groups is essential to building a constituency for such projects, as well as cultivating a pool of local volunteer stewards for monitoring and education programs.

If we are to create a community of stewardship, empowerment is only part of the equation. The other part is education, stories, and ritual. The local public must play an important and visible role in the planning, installation, and monitoring of regeneration and ecosystem managment. Woods (1994) remarked on the high level of community anticipation and involvement in prescribed burns at the University of Wisconsin Arboretum's Curtis Prairie. In what has become an annual event, volunteers shape their restored savanna ecosystem in festive style; the number of participants grows each year, contributing to what has become a new urban ritual in the Madison area. This “ritualized” aspect of urban ecosystem management has been characterized by several researchers (Holland, 1994; Hartig, et al. 1994; Freehafer, 1995), who see it as a response to individual and collective societal needs to

1.Biodiversity translates into city parks that are rich in natural experiences. City parks that have healthy and diverse habitats can offer complex experiences, including the sights and sounds of wildlife as well as the experience of natural environments, which are both immersive and intense (forests, wetlands) and at times expansive and contemplative (fields, ridge views).

2.Biodiversity and ecosystem functions contribute to improved water quality, land and soil regeneration, and pest control. Ecosystems that are out of balance and diminished in diversity require greater care, including fertilization, soil stabilization, and insect control.

3.Plant communities with a diversity of species require less maintenance and teach us to work with nature and to recognize natural cycles and systems.

4.Understanding biodiversity and its effects can help us understand ecosystems value and management in urban settings. If we can teach the value of diversity and ecosystem interrelationships in populated city environments, the protection and value of wilderness systems will be easier to sustain in the future.

reconcile with the earth and nurture the local natural places around them.

Pittsburgh has begun one such ritual in the “Bioblitz” initiated by the Carnegie Museum of Natural History. (Explained in the section on education above.) Biodiversity refers to all the different kinds of plants, birds, mammals, insects, amphibians, reptiles, fish, and other organisms in an area. It can be measured in many ways, including species richness (number of different species); abundance (number of individuals of each species); adaptations (variation among individuals of each species); and habitats (different kinds of places). The biological components of an area (the plants, animals, and other life forms, such as bacteria and other single-celled organisms) and their interrelationships with the soil, water, and other non-living factors make

BioBlitz '98 was a hit. We had a good public turnout with estimates of 1,200-1,500 people participating in some aspect on Saturday. About 300 kids participated in the Junior BioBlitz and over 150 people were at the Twilight Picnic. Patty Dineen, CMNH docent who manned the specimen display table, made a rather accurate count of 540 visitors to the "scientists' base camp" on Saturday.

The final species count at 3 pm on Saturday was 1,471 (compared with 1,164 for last year's BioBlitz at Riverview Park).

The breakdown by group is:
- Insects - 974 species
- Plants (including mosses) - 344
- Birds - 83
- Amphibians & Reptiles - 15
- Mammals - 15
- Fish - 2
- Other - 38

Interesting finds this year include:

Mile-a-minute weed -- A horrible, thorny vine that is listed as a noxious weed in PA. Already a problem in southeastern PA and elsewhere in the east, it wasn't really known from western PA. Will need to get yunz an image so that folks in Frick/NMR can be on the look-out for more in the area. Steve Grund from the Western PA Conservancy found one population (8-10 sq. m) in zone 3 and is checking out precisely where (he says it's at the edge of a field in that area). I'm contacting Citiparks about a weed pull -- perhaps we can nip it in the bud!

Ravine Salamander -- Species restricted to southwestern PA and not found in Frick since the 1950s. It's still alive and well and presently getting its little picture taken.

Surf Scoter -- A sea bird not previously noted from the Frick vicinity. Maybe from the air the slag looks like dunes??

New herps for Frick Park -- American Toad, Northern Ringneck Snake, and Bullfrog. Sorry, still no Copperhead.

Botanists added over 60 plant species that had not previously been reported for Frick/NMR.

Mammals -- Lots of traps set, but only one little mouse caught. All other records were from sightings, tracks, other sign. Beaver seems to be their most exciting find. Mammalogists attribute the low trapping activity to the hot weather.

Bugs -- Lots and lots and lots of species still being counted.

up ecosystems. Although people usually associate biodiversity with rainforests and other wilderness areas, these concepts are important in Pittsburgh and other cities for the following reasons:

Information on the Pittsburgh Bioblitz can be found at:
http://slaggarden.cfa.cmu.edu/bioblitz/index.html

VII-j4. Conclusion:

NMR is an ecosystem that has been damaged by decades of industrial dumping, residential sewage, and urban runoff. To heal that ecosystem--and make it a vital part of the region's quality of life--we need concerted civic action on the part of various municipal governments, regulatory agencies, and citizens groups.

But this is only one part of the story we have been telling here. NMR presents not only problems to be solved but opportunities to be appreciated, right now and in the future--opportunites on both the individual and community levels for education, research, experience, and even inspiration. Every "problem," in fact, can be redefined as an opportunity: to learn more about how urban ecosystems function, to renew our appreciation for our natural and cultural heritages, to change our whole way of thinking about the role of ecology in our daily lives. What we are proposing in this document, therefore, is not simply a list of technical "solutions" but a more fundamental change in our attitude toward urban ecosystems. First and foremost we need to foster an attitude of appreciation and wonder for NMR as a place (and a system) of unique value in our region. From this attitude comes inspiration and motivation; from inspiration and motivation comes the creative action and stewardship necessary to regenerate the ecosystem and maximize its opportunities.

With the importance of this attitude always in mind, we can summarize our specific recommendations:

- Create a watershed management authority to implement a plan to reduce sewage flow and urban runoff into the stream
- Build a keeper's cottage/educational facility on site
- Institute pilot projects to restore specific habitats,
- Control invasive plants, revegetate slag, and reintroduce particular species
- Enhance the two existing wetland sites
- Expand educational programming
- Create stewardship rituals.

FINI