

**An Evaluation of Incorporating Recreation Opportunities in Industrial
Environmental Remediation Projects**

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Table of Contents

Abstract.....	ii
Introduction.....	4
Importance of Environmental Remediation.....	5
Criterion for Incorporating Recreation in Industrial Remediation.....	6
Ideal Sites.....	10
Figure 1: Evaluation of Criterion for Ideal Sites.....	11
Marginal Sites.....	13
Figure 2: Evaluation of Criterion for Marginal Sites.....	13
Undesirable Sites.....	16
Figure 3: Evaluation of Criterion for Undesirable Sites.....	16
Conclusion.....	18
References.....	20

Abstract

The industrial revolution has forever altered or placed at risk many natural ecosystems in the United States to the point that they require remediation. Environmental remediation seeks to enhance and protect the health and well-being of ecosystems through the removal of pollutants or contaminants from soil, groundwater, surface water, or sediments. While it is important to limit human interactions in particularly sensitive ecological remediation activities, former industrial areas may present an excellent opportunity to introduce communities to remediation without the fear of further damaging the already degraded ecosystem. One way to introduce people to remediated sites is to incorporate recreation capacities within remediation plans. Building walking trails, ATV use trails, playing fields, or constructing wildlife habitat for public viewing can provide substantial recreational benefits for citizens. This paper describes areas that are ideal, marginal, and undesirable to incorporate recreation opportunities with remediation. Judgment of these three classes of sites occurs based on the following: level of degradation, remediation recovery path, amount of pre-existing infrastructure, access, and budget. From determining how to define the three types of sites, it became clear that a majority of industrial remediation sites would not fall into the ideal or even marginal categories. Overall, despite most sites not being ideal, incorporating recreation in industrial remediation should still be studied as a viable option. If this option continues to be researched and developed, it will encourage the development of technologies, which will allow a shift of more marginal and undesirable sites into the ideal category, which will have profound positive impacts on the health of the environment as well as the post-industrial society of the United States as a whole.

Introduction

Environmental remediation seeks to enhance and protect the health and well-being of ecosystems through the removal of pollutants or contaminants from soil, groundwater, surface water, or sediments (Falk, Palmer, and Zedler 2006). Many active industrial or former industrial sites are monitored for pollution or are actively undergoing remediation methods to improve the quality of the sites and reduce the harmful impact their pollution has or has had on their surrounding environments.

Many techniques are employed to reduce ecological impacts and remediate surrounding environments. Wetland and pond construction to collect runoff, as part of mitigation, or remediation is greatly beneficial to the health of ecosystems surrounding industries. Planting trees and reintroducing native species into formerly degraded ecosystems also greatly help the ecological well being of environments (Falk, Palmer, and Zedler 2006). All of these remediation techniques are similar in that they are mostly expensive, and once put into place the public rarely gets opportunities to interact with or witness the progress of the environmental remediation their tax paying dollars have gone to implement.

Another technique to lower the impacts of pollution, actively remediate a site, and gain positive site interactions with the public at large, is intertwining a recreation component to industrial remediation sites. As this paper describes, there are many considerations to make before implementing a recreation plan for a remediation site, and the decision should not be made hastily. However, if the right conditions are present, implementing a recreational element into environmental remediation plans can provide quite beneficial results for society.

The US EPA in last decade has reflected the sentiment that remedial efforts may provide unexpected values for communities. The Return to Reuse Initiative of 2004 reflects an evolution

in the understanding of remediation and the usefulness in providing communities the ability to envision the long-term remedial goals of a site, which often times include recreation (Cook and Friedland 2005). This initiative has studied the long-term stewardship goals of many Superfund sites including ways initial remedial planning takes place, the way sites begin to be reused, and the values that communities place on these sites (Cook and Friedland 2005). This fundamental change from viewing brownfield sites and other contaminated areas as wastelands to be quarantined, cleaned, and then left alone, to areas which may still hold value to a community presents a vital opportunity to begin the discussion of incorporating recreation with remediation.

Importance of Environmental Remediation

Environmental remediation is a very important part of modern society. As industrialized cities have grown rapidly over the past century, often times environmental concerns such as pollution, ecosystem maintenance, habitat protection, human health, and endangered species have taken a back seat to a notion of technological progress.

Implementing environmental remediation, especially to those sites most degraded by industrial activities is a very important part of maintaining environmental sustainability. Reconstructing the environmental aspects of a degraded site, and rehabilitating a site to perform an intended natural ecosystem function can positively transform degraded wastelands into areas which can provide a positive purpose to society at large; either through societies direct interaction with the site or with the indirect advantages associated with a cleaner, healthier environment (Falk, Palmer, & Zedler 2006).

While all degraded sites can benefit from an environmental remediation program, it is important to distinguish between sites where the most good for the least amount of cost can be

done. It is also important to consider where the most people will benefit from an environmental remediation project. While the environment would greatly benefit from remediating all degraded sites, limited funds mandate that choices to be made about which sites get the most attention, and it is important to weigh the costs and benefits associated with each remediation with regards to human health and the environment (Anderson 2010). So too is it important when considering degraded sites to implement recreation plans as part of an environmental remediation.

Criterion for Incorporating Recreation in Industrial Remediation

There are a variety of ways to incorporate recreation plans into environmental remediation. With each site being different, it is the responsibility of site managers to determine the best ways to incorporate different aspects of a remediation plan including potential recreation. Each site will have different overall goals, and there will be a varying level of practicality of implementing different types of recreation.

An example of recreation that could be implemented, would be constructing walking trails around a formerly degraded site, or using existing infrastructure to overlay walking trails (see Ideal Section on "Rail to Trails"). This type of developed infrastructure limits the amount of further degradation to just where a site manager installs the trails. Areas off the trail could be managed for rare species or wetlands mitigation if need be. Incorporating access to these areas also allows the public an opportunity to see and interact with an area first hand. These types of trails could provide excellent opportunities for bird watching, hunting or fishing (depending on pollution and safety concerns), ATV or snowmobile use, and for educational centers to teach people about environmental remediation or about the ecological processes taking place on the site.

Many cons have prevented much progress with incorporating recreation with industrial remediation so far. The omnipresent con is and always will be cost. It is expensive enough as it is to monitor sites during environmental remediation, and without a direct benefit to a business or corporation there is not any reasonable reason to implement a recreation plan as part of environmental remediation. A study of the Menomonee Valley Industrial Center and Community Park (MVIC) in Milwaukee, Wisconsin by David P. Misky and Cynthia L. Nemke declares that without participation from numerous funding sources the MVIC would still only be a "good idea" (Misky and Nemke 2010). Construction of the park took place on a remediated brownfield site located near industrial plants that constructed railcars. Economic factors lead to layoffs and high unemployment in the area in the late 1980s and the plants subsequently closed, leaving behind environmental contamination and buildings, which would soon fall into disrepair. With a great amount of public-private cooperation, and the help of a \$16 million grant, the brownfield site transformed into a vibrant industrial park connected by recreation trails to nearby communities (Misky and Nemke 2010). An important distinction about this project that Misky and Nemke make clear is that this project would not have taken place without public-private cooperation and generous funding from a multitude of sources. Funding is the key aspect to incorporating recreation with remediation. Remediation takes precedents and is costly on its own. Adding a recreational element adds costs and without cooperation and ample funding, it is highly unlikely incorporating recreation elements into remediation will occur (Misky and Nemke 2010).

Pollution already exists as an economic externality which society as a whole through government policies has required companies take responsibility for (Anderson 2010). However, with companies recognizing the profits to be made by labeling themselves as "sustainable" or

increased worker productivity by providing on-site recreational opportunities this presents an opportunity for companies to take charge and make positive changes before the public demands it. Other reasoning which prevents recreation from being incorporated into remediation involve ownership issues. By providing recreation the owner of the land assumes liability if any accidents occur. With industrial sites being a key focus, this is a large obstacle as most sites may be polluted with chemicals, or other hazards common among industrial sites. These could pose threats to the health and safety of visitors which would be a major reason not to proceed with a recreation plan. There has been much study regarding the risk posed to individuals recreating on contaminated lands. One notable 1997 study by Joanna Burger finds the average number of recreation day's people participated in Columbia, South Carolina was over twenty days per year (Burger 1997). This exceeds the Department of Energy's fourteen-day recreation assumption limit they placed on remediated lands (Burger 1997). This not only emphasizes the severity of potentially exposing the public to dangers but also that further study needs to take place on how well technologies are developing to handle pollution, and also potentially places limitations on how usable remediated sites may actually be for recreation. This is a major downside that requires much more study, if a person exposes themselves to dangers after only visiting a site fourteen times in a year, it most likely would not be worthwhile to continue with recreational development.

However, there are many pros of incorporating recreation in environmental remediation. Incorporating recreation can allow access to recreational opportunities for many people who may not have access to it otherwise. Many industrial remediation sites are in larger cities with a large urban population who could greatly benefit from a healthier environment and more green space. Another benefit is building community awareness around environmental issues affecting

neighborhoods. Most environmental pollutant monitoring takes place behind closed doors with neighbors and often times even workers unaware that monitoring is taking place for chemicals discharged from a plant, or disposed of on a site right in their own backyards. Raising awareness of the prevalence of pollution will help build a more eco-conscious society, and incorporating the public further into the environmental remediation process would be a great first step.

Incorporating recreation also allows for the use of crowd sourcing data. All remediation sites require careful monitoring. Whether this be stream flows, species counts, or other specific environmental data, introducing the public to these environments can help take some of the burden off of industries. As shown by Dr. Chris Lowry's study of crowd sourcing stream flow data, these types of experiments can be greatly successful and surprisingly reliable (Lowry and Fienen 2013). With enough participation, outliers can be easily identified and solid reliable data can be collected in this manner (Lowry 2012).

Allowing this access to information also gives site users and community members common experiences to build a sense of communities. In many towns affected by the pollution of the industrial revolution, the industries and surrounding environments are what hold a community together. As is the case in Amsterdam, New York, a small city on the Mohawk River which used to employ thousands of people in booming carpet mills and other industries. Most of the community identifies with the Mohawk River or the main tributary running through Amsterdam, the Chuctanunda Creek. Water levels and flows are a common topic among residents during rainy months when the river is high and the creek runs through town like a torrent. In Amsterdam's booming factory days of the late 19th and early 20th centuries, it is said people used to be quite impressed by the colors of the creek, which would change from purples to greens to pinks depending on what color dyes the factories were using that day (Snyder & Von

Hasseln 2010). This stirred a lot of conversation (and perhaps concern) amongst the public (Snyder & Von Hasseln 2010). This goes to support that people have always been at least interested and curious about pollution in their environments and it is what can draw a community together.

The natural ecosystems in which societies have developed are fundamental in providing services on which society benefits from both physically and perceptually. The natural environment is a common ground all people must interact with every second of their lives, and as such, changes cause great alarm and can stir a lot of emotions and conversations among people. Why not then, harness this fundamental interest into incorporating the public at large into remedial activities, through providing recreational and educational opportunities.

The purpose of this paper then, is to sift through the pros and cons of incorporating recreation with environmental remediation to determine a foundational structure on which to decide whether or not to develop strategies for implementing recreation.

Ideal Sites

Based on the pros and cons of incorporating recreation with environmental remediation in industrial settings, ideal sites to do this would be minimally degraded, already well-along a path to ecological recovery, sites with pre-existing pollution infrastructure, sites with pre-existing building which could be repurposed, sites in inner cities, well budgeted sites, and government owned or budgeted sites. Each of these qualifiers for ideal sites provides large benefits for recreation opportunities at minimal costs. Figure 1 is a chart developed to outline criteria for determining an "ideal" site.

Figure 1:

Evaluation of Criterion for Ideal Sites

Criterion	Evaluation
Level of Degradation	Low to Mid Level of degradation should not pose an immediate risk to users, and should be easily contained. Should be at least in the process of being treated if not already fully remediated.
Remediation Recovery Path	Should be well along the path to full recovery.
Pre-Existing Infrastructure	Sufficient to support users and in good operational condition.
Access	Easily accessible to appropriate number of users.
Budget	Large flexible budget enough to cover incremental costs of providing recreational opportunities on top of remedial projects budget.

Incorporating recreation on minimally degraded sites is especially ideal. This minimizes the costs of having to actively monitor a site or worry about exposing the public to harmful pollution.

Another important qualifier of ideal sites is they are already well along a path to recovery. Implementing recreation too early in a remediation plan may degrade a site further as sensitive species trying to reestablish themselves can be particularly vulnerable in the beginning phases of remediation.

Sites with pre-existing infrastructure including buildings and pollution controls are also ideal. These sites require minimal additional investments for ensuring future pollution is kept to a minimum while recreation is occurring as well as provide buildings for educational centers, bathrooms, and other important considerations when evaluating any type of recreational facility. Having these things already on site greatly reduces the cost to establishing recreation activities.

Inner city sites that display some of these other characteristics are also ideal. It is important that incorporating recreation in industrial remediation not leave behind inner city industries. While these may be more heavily polluted, the societal benefits in these instances greatly outweigh the costs of cleaning up these sites to provide recreational opportunities.

Well-budgeted sites are also ideal. Any remediation project is costly, and implementing additional provisions such as providing recreational opportunities to society add tremendously to this cost. Thus, well-budgeted sites are best, to ensure quality remediation is occurring while recreation opportunities are established.

Government owned or funded sites are especially ideal. These sites have steady funding and also the benefit of having liabilities covered in case of accidents. This takes some of the cost burdens and liability concerns away from corporations or industries that otherwise may be prohibitive.

Two examples of ideal programs or sites that exhibit these characteristics would be the Rail to Trail program and the remediation program taking place at Carrier Corporation in Syracuse, NY. The rail to trail program takes old abandoned or economically impractical rail lines and transforms them into walking trails. This would qualify as implementing recreation on former land used for industry and remediating it to serve a public purpose. Most rail lines are minimally degraded and very flat, making them ideal locations to install easy walking trails. The cost of remediating the site is minimal as it is not very heavily polluted. A majority of the costs come from removing the rails and installing the trails, which could be offset by implementing user fees.

Industries often employ large numbers of people during operation requiring expansive parking lots for employees. However, as industries move on or down size due to any number of factors, they often leave behind these large expansive, minimally degraded, paved areas often times many acres in size. This would also be an ideal location to implement recreation, as parking lots are often flat and large. Tearing up asphalt and perhaps installing wetlands and walking trails could help mediate for industrial activities which may or may have not taken place

by the industry and also improve the corporate image. This is exhibited by Carrier Corporation where large sections of asphalt parking lots and abandoned warehouses have been leveled and will be replaced by recreational fields operated by the Town of Dewitt in conjunction with Carrier Corporation (Johnston 2012).

Overall, sites considered "ideal" meet or exceed the guidelines outlined in this section, although each site is unique and will require careful evaluation of all of these factors to do a proper cost benefit analysis.

Marginal Sites

The next type of site analyzed would be marginal sites that care should be taken in incorporating recreation. This type of site may exhibit some ideal characteristics but may also have a balance of inhibitive costs that would require a great deal of thought to take place before allocating resources to go forward with recreation in these instances. Figure 2 outlines criteria for determining "marginal" sites.

Figure 2:

Evaluation of Criterion for Marginal Sites

Criterion	Evaluation
Level of Degradation	Mix Level of degradation should not pose a n immediate risk to users. Although degradation may not be fully contained or remediated.
Remediation Recovery Path	May be on the path to recovery but may also need more time.
Pre-Existing Infrastructure	May need small additions or repairs.
Access	May be semi-easily accessible but may also be remote, or require some additional infrastructure.
Budget	May be well to moderately budgeted, may need to implement user fees to help offset costs of providing recreation.

Such a site may be moderately degraded to the point where extra monitoring or policies may be in place inhibiting recreation on or around the area. In these instances, care needs to be taken in implementing recreation because the costs of remediating the site to a point where recreation can take place may outweigh the benefits a recreation site can provide to society.

Ecologically sensitive sites must have great care taken also. It is important to steer walking trails or playing fields away from ecological sensitive or species in the beginning phases of recovery. These species are particularly vulnerable during their establishment, and allowing recreation to take place too close may have a negative overall impact on the remediation of a degraded site.

Sites with minimal pollution controls or minimal pre-existing infrastructure should also have care taken when incorporating recreation in the remediation plan. Constructing new infrastructure on a site will be costly, so it is important to have a solid remediation plan in place as well as sufficient funding before considering incorporating recreation. For the same reason sites which are barren should have care taken if implementing a recreation plan as part of the remediation.

Sites which are moderately remote should also have care taken if implementing a remediation plan. Especially if revenue generated from entrance or user fees is going to be invested back into the remediation project it is important that people have easy access to the site or that user fees are set appropriately to account for people needing to travel to reach these locations. In the instance of remediated sites people are much less likely to travel great distances to recreate on formerly polluted land than they would to recreate on closer, cleaner areas.

Poorly funded sites are also less than ideal, however in some instances recreation plans may be able to work with this type of remediation. If a site is struggling for funds to pay for

remediation and just re-building the ecosystem, recreation plans should take a back seat to the health of the environment. However, if it is believed incorporating recreation may be able to attract more people and generate revenue for the site, then in this instance it should be at least considered.

Industrial remediation sites that have complex monitoring or regulating guidelines to follow should also be careful when considering implementing some form of recreation. While through such methods as crowd sourcing data, and strategically setting up monitoring equipment along walking trails can help educate the public and take some of the pressures off of monitoring sites, if this monitoring is too complicated or sensitive it may be best to leave it to professional experienced environmental engineers and field technicians.

Some examples of locations that fit these criteria would be closed non-hazardous landfills past the monitoring stages, or storm water discharge basins and creeks. Closed non-hazardous landfills exhibit relatively good opportunities for ATV, snowmobile, or non-consumptive hunting activities. As long as the site is not actively being monitored for pollution, and does not contain any contaminants which may pose a threat then these sites may be good candidates due to their ease of access (most landfills have large roads built for heavy trucks running all the way through them) and simultaneous relative seclusion. What is concerning however, are the liabilities about what pollution lays under the ground and certainly in depth costly studies would have to be performed before allowing this type of recreation. Storm water discharge basins and creeks may also provide recreational benefits as part of a remedial plan but care should be taken with these as well. These areas would be prone to flooding, which may release contaminants into the area or pose a danger to users. Certainly care should be taken to

understand what is being discharged and from where exactly before allowing recreation along these basins or creek corridors.

Overall, as technology gets better and better, these types of sites will become more and more accessible to the public for recreation. Currently however, the cost obstacle stands in the way of establishing recreation opportunities at these sites.

Undesirable Sites

Although changing technology will undoubtedly lead to changes in the way remediation is approached, and ultimately decrease costs of remediation while increasing the effectiveness and efficiency of remediation, for the present remediation faces very real fixed costs and problems, which are prohibitive to implementing recreation opportunities. Figure 3 outlines criteria for determining "undesirable" sites.

Figure 3:

Evaluation of Criterion for Undesirable Sites

Criterion	Evaluation
Level of Degradation	Mid to High or unknown Level of degradation is either above acceptable limits or unknown and may pose a risk to users.
Remediation Recovery Path	Beginning stages of recovery or threatened or endangered species are present.
Pre-Existing Infrastructure	Either non-existent or in disrepair.
Access	Very limited or non-existent access.
Budget	Very limited or non-existent budget.

These include sites with overt hazards, sites still under investigation with many unknown factors regarding extent of pollution or the extent of remediation necessary. These sites place potential recreation users at risk of injury or somehow in harm's way. Exposing the public to potential harm is a major reason not to go forward with recreation. While some element of

danger may always exist, it is important that the technologies in place and the remedial efforts occurring do not directly put users in harm's way.

Remote sites and sites with no funding should also be avoided. These sites simply lack the access necessary to support installing recreation capabilities. Remedial activities should definitely continue, but the benefits the public may receive from a walking trail, or other recreational infrastructure may not be as great as those more easily accessible. However, when considering ATV, snowmobile, or potential hunting areas remote sites may decrease user conflicts with surrounding neighborhoods. Even with these types of sites, access is key and if the funds and users are not readily available, there is little reason to move forward with incorporating recreation.

Extremely complex or delicate remedial sites in the sense of either monitoring or technological processes taking place or endangered or recovering species located on the site should be avoided as well. These sites may be immensely sensitive to different types of recreation use. Installing walking trails may indirectly lead to users wandering off and trampling sensitive vegetation. Using ATVs or snowmobiles emits gasoline range organic compounds into the air, which may through off gas meter readings. Hunting or fishing access may also pose risks to a newly recovering ecosystem if not properly established.

Sites still operating, actively still discharging, or using some chemical process on the site should also be avoided. These also expose the public to unnecessary harms of industrial activities.

Some examples of sites which fit these criterion are active landfills, or inactive landfills still being monitored for gas release. Still actively operational industries at full capacity should be avoided. Sites that have known levels of extreme contamination like former dumps without

proper liners or modern standards of waste pollution control. In general, these sites are ideal candidates for remediation projects however, at least with current technologies recreation should be avoided on these types of sites.

While these types of sites should be avoided for the hazards, costs, or liabilities that define them, advancing technologies in the field of ecological remediation may soon lower costs or find ways to lessen the hazards of incorporating recreation in these remediation plans. This emphasizes the importance of pushing the boundaries of remediation to incorporate other activities such as recreation. Through operating at this boundary of what is possible and what is thought may be possible, the field of ecological remediation may be able to find allies in business, society, or governments to help further advance technologies and the ways in which society interacts with the natural world.

Conclusion

Overall, incorporating recreation with remediation plans on former industrial sites is no easy tasks. From this study of where recreation is currently being implemented in remedial efforts, it can be seen plainly that low impact industrial sites such as abandoned railways and parking lots have already been targeted and utilized for implementing recreational facilities. The next step, would be to overcome the obstacles in place making slightly more degraded sites not feasible for recreation. Not many examples of recreation exist with remedial efforts on these type of sites because of obstacles such as excessive degradation, contamination, costs, or liabilities. Overcoming these obstacles would be ideal to expand the public's knowledge of remedial efforts in their own backyards as well as provide the societal benefits of green space and recreational opportunities. While every site is different and presents its own unique

challenge for ecological remediation, as technology advances and the overall understanding over remedial processes expands, it will become easier and easier to expand the implementation of recreation on sites formerly too polluted to repurpose. As society becomes better educated and cognizant of the societal benefits of green spaces and recreational opportunities as well as the cognizant of ongoing projects to remediate areas close to them, the number of these projects will grow. While there are many obstacles now, society is at a turning point with realizing how to utilize and remediate polluted sites now that green space and recreational opportunities are growing scarcer and scarcer.

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