Parking Lots:
Case Studies and a Model Ordinance

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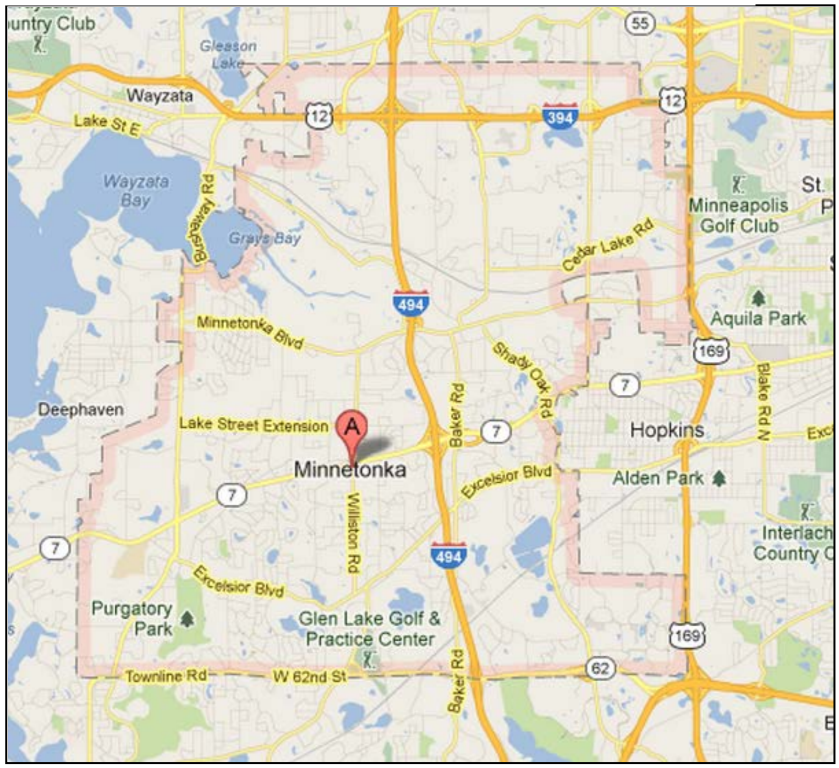
Introduction

Figure 1. Minnetonka and Neighboring Communities



Minnetonka is suburban community of about 50,000 people located in the southwest Twin Cities Metro Area. The majority of the city is low density residential. Minnetonka does have several major economic areas, including Ridgedale Center and Opus Office Park. Figure 1 shows Minnetonka in relation to its neighboring communities. Lake Minnetonka, pictured on the cover page, is one of the biggest lakes in Minnesota. The city also contains Minnehaha Creek and many wetlands. In the near future, the Southwest Light Rail line will run through parts of Minnetonka. All of these different land uses and activities have brought up some issues with parking regulations and land use forms for the city.

The City of Minnetonka wants to update its parking policy to more accurately reflect its goals of creating efficient land uses, facilitating higher density development, encouraging conservation design techniques, and reducing storm water runoff from surface parking. Like many cities, Minnetonka currently has a minimum-parking requirement in its parking ordinance. However, the city recognizes that this must change in order to meet the stated goals. Minnetonka is open to modifying parking requirements to meet average demand instead of peak demand, establishing a maximum parking ordinance, and providing flexibility for landowners to meet parking needs through shared parking or other means.

This analysis will first provide a literature examining many of these issues in relation to parking. This will provide the necessary background to propose several innovative ideas to Minnetonka to combat its issues with parking. In order to better understand the current parking situation in Minnetonka, the city's ordinances and those of neighboring communities are discussed. The literature review and parking regulations in neighboring communities will allow us to determine some recommendations for the City of Minnetonka. Lastly, we will provide the city a refined ordinance that can be applied in order to put the city on the right track to meeting its goals.

Methodology

To address some of these issues, we will review research and look at what neighboring communities are doing. First, we will examine peak parking, underutilized parking, and neighborhood parking research. Next, we will look at storm water management and conservation design techniques for parking lots. Finally, we will help determine recommendations for parking lots in the City of Minnetonka.

Peak and underutilized parking

Like morning and afternoon peak period traffic congestion, parking also experiences peaked consumption. Various businesses experience the peak demand at different times. A church likely sees its peak demand on the weekends around their services, a movie theater in the evenings, and offices during the traditional 40 hour work week times. Businesses also see changes in parking demand by season. Retailers see their highest demand between Thanksgiving and Christmas. It has become custom in most U.S. cities, due to the automotive centered culture, to provide an abundance of (usually) free parking. Abundant free parking has become so ingrained that many feel it is a constitutional right (Shoup, 1999). However, as one learns in Econ 101, there is no such thing as a free lunch. In the case of parking, there is no such thing as "free" parking (Shoup, 1999). The price may be hidden, but consumers and businesses are paying the full cost of parking and the cost is significant. Shoup estimates the cost of above ground parking at $10,000 per spot and underground at $25,000. In a survey of office buildings in L.A., parking equated to 27% of the construction cost for above ground parking and 67% for underground (Shoup, 1999). The cost is so significant that Shoup believes the value of parking spaces in the U.S. exceeds the value of vehicles. If consumers are not paying for parking directly, the expense becomes bundled in the cost of goods and services.

In addition to the negative environmental effects caused by free parking, especially surface parking, free parking creates problems for pedestrians, decreases land density, and increases auto ownership and usage (Weinberger et al., 2009). Estimates put parking at 16% of land use in U.S. Metro areas (Shoup, 1999). These are negative externalities which are not absorbed by the parking developer.

As Shoup discusses, minimum parking requirements have a fairly arbitrary start and have become commonplace through the practice of cities adopting the policies of their neighbors, thereby further exacerbating the problem. The requirements are often based on very few observations of peak demand in suburban areas. Nevertheless, the results are applied to all areas for all times of day (Shoup, 1999). The result is excessive parking and the problems associated with it. Cities may enforce minimum requirements in order to reduce the spread of parking to neighboring residents or businesses.

There are, however, other options cities can take. As Weinberger et al. (2009) state, residential parking permits can be given out to prevent spillover. Shoup recommends a different course of action. He proposes pricing on-street parking based on the market. The rate would be set to allow for 15% vacancy to avoid cruising for parking. In order to make this politically feasible, profits should be funneled directly back to the neighborhood. Residents would then see the benefit of such a program. Cities could decide whether to issue residents special permits which allow them free street parking or not. Weinberger et al. (2009) discuss how off-street residential parking drives up housing costs by bundling parking and essentially acts as a prepayment on a car. Especially in cities like New York, where off-street parking is not commonplace for each resident, the supply of off-street residential parking increases auto ownership and auto share for central business district (CBD) commutes (Weinberger et al., 2009).

With such high tech solutions available, Shoup (1999) believes charging for on-street parking is a political problem, but certainly not a technical one. The technology can be used to apply variable pricing for times of day or location. Rates at peak hours will be higher and spots in greater demand will see higher prices just as parking in the CBD is more expensive than suburban parking. Preference can be retained for the handicapped and even given to carpoolers.

As with any policy change, the government reserves the right to regulate. This can help assure certain interests are protected if a city is worried about the results of a parking policy change. This may be in the form of regulating cost, amount of spaces, or the time of parking among other things.

Free parking has become so ingrained that it is treated as an entitlement (Shoup, 1999). People do not realize they are indirectly paying for free parking. For those who use transit or other modes of transportation, they are also paying for parking because users of all transportation modes subsidize free parking. Those driving less are subsidizing parking for those who drive more. By indirectly paying for parking, the marginal cost of driving decreases and the demand for driving goes up. By scrapping minimum parking requirements and charging for on-street parking, the supply of parking will decrease, but so will the demand (Shoup, 1999). People will experience a greater marginal cost, because the cost of parking is no longer bundled, and some may shift modes or travel during other hours. This has the benefit of acting as a travel demand management measure.

Charging for on-street parking may be an option in urban environments, but will be more difficult in suburban areas where parking is almost always "free." Feitelson and Rotem (2004) propose a tax on surface parking. They feel this tax could be used in urban and suburban areas. There are various negative externalities associated with parking. Not all of these externalities can be easily quantified and charged to the corresponding party. Taxing surface parking attempts to internalize these externalities (Feitelson and Rotem, 2004). In implementing such a tax, cities would need to get rid of minimum parking requirements (Feitelson and Rotem, 2004). Otherwise, a conflict of interest might occur where cities would propose high parking minimums and then tax them. The tax would be on land use for parking and not per spot, thereby reducing the cost of structured parking, especially underground parking. The additional construction costs of structured parking would be more equal with surface parking due to the greater tax on the surface parking (Feitelson and Rotem, 2004). A surface parking tax would discourage developers from building excess parking, and encourage shared and mixed use parking. The cost of implementing such a tax would be low. Cities could decide to apply it just to new development or also existing. Applying a surface parking tax to existing development could encourage businesses to reduce excessive parking and develop the land for other uses. Alternate uses could include green space, additional retail, or even high density residential. In order to make the tax politically feasible, Feitelson and Rotem (2004) propose that the tax be revenue neutral by reducing property taxes or reinvesting the income back into the area.

Applying a surface parking tax relies on the removal of minimum parking requirements. If cities were to remove minimum requirements and not implement a tax on parking, would the parking supply be reduced? Engel-Yan et al. (2007) did a parking survey in Toronto in order to predict what would happen if parking minimums were erased. They looked at existing developments to see how many parking spaces they were supplying. Of particular interest were businesses that were supplying less parking than the city's minimum. Reasons for this included development before parking minimums existed, particular exceptions, off-site parking or cash in-lieu payments. The amount of developers under the minimum acted as a predictor of future development in-lieu of a minimum requirement. Engel-Yan et al. (2007) determined that erasing minimum parking requirements would likely affect general office, medical office and general retail, but would have little effect on large grocery stores and banks that are supplying parking in excess of the minimum requirements. However, they determined that banks and grocery stores contribute to a very small percentage of trip generation and therefore, their excess parking would have little effect on driving demand. Engel-Yan et al. (2007) believe that other retailers and office developments would develop less parking if they were no longer forced to by the city.

Conservation Design and Storm Water Management Techniques

Parking lots have many effects on the surrounding landscape, including environmental, economic, and social costs. Many of these effects stem from changes in hydrology caused by parking lots. The asphalt used in parking lots creates an impervious surface, meaning a surface that blocks the infiltration of water. Since the water is not absorbed into the ground during rain events on parking lots and other impervious surfaces, the result is an increase in runoff. “An impervious, man-made surface will generate two to six times more runoff than a natural surface" (US-EPA, 2009).

In order to deal with the increased runoff, the traditional engineering solution has been to funnel the water from impervious surfaces into water bodies as quickly as possible since it is unable to soak into the ground. The result is a greater volume of water at a high velocity into water bodies, and a reduction of groundwater recharge (Cook, 2007). The changed water input can increase flood risks and erosion. Counter intuitively, some stream flows may be reduced due to the reduction of groundwater recharge. Essentially, parking lots and other impervious surfaces change hydrology in a variety of ways.

In addition, runoff can overwhelm local sewer systems. If storm water runoff is too great, combined storm water and sewage effluent may be released directly into local water bodies. Parking lots also contribute to nonpoint source pollution. Debris and pollutants, such as oil and salt, are washed from parking lots into the watershed. These pollutants are harmful to aquatic life and threaten the safety of drinking supplies and recreational water uses.

Another environmental effect of parking lots is increased temperatures. Asphalt absorbs heat and contributes to the urban heat island effect. The US-EPA states (2009) that "recent research indicates that urban areas are 2 to 8ºF hotter in summer due to this increased absorbed heat" by impervious surfaces and loss of cooling vegetation. Runoff from parking lots is also heated, resulting in warmer water being added to streams. Temperature increases can harms aquatic life. Heat concerns are magnified in the context of global climate change that has brought a trend of more hot days to Minneapolis.

Furthermore, parking lots contribute to air pollution. Asphalt emits polluting air emissions while the parking lot is being constructed, and continues long after the lot starts being used. Vegetation removed to build parking lots had formerly helped to remove carbon dioxide from atmosphere. In addition, parking lots encourage automobile use that will emit more air pollutants.

Other environmental effects of parking lots are their support of sprawl development and an auto-dependent society. Habitat is disturbed and fragmented by them. Parking lot construction also consumes valuable petroleum and aggregate stone resources (American Rivers, 2004).

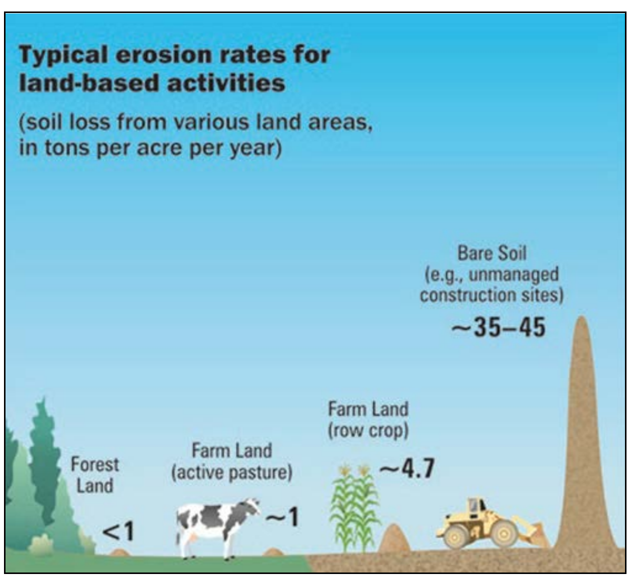
In addition, parking lots have economic and social costs. Developers and ultimately consumers pay money to build and maintain parking lots. Local governments must pay for more storm water infrastructure to manage increased polluted runoff. Reduced infiltration rates may lower the water table, and increase costs of pumping groundwater (US-EPA, 2008). Heat island effects from parking lots can decrease the energy efficiency of buildings. Parking lots also do not bring in as much tax money as most other land uses. Furthermore, parking lots do not serve people who do not use them, bringing up equity concerns. This is unlike other uses such as green space that can still benefit people who do not visit the land. Parking lots can have negative health consequences for non-users stemming from air and water pollution. Overall, parking lots may decrease a community's livability and threaten its unique identity.

Even though parking lots have many negative consequences, it is very unlikely they will be completely eliminated. Cars remain the staple of the American transportation system. Nevertheless, there are ways to limit some of the negative impacts of parking lots. "Green lots" have several benefits. Green lots use design techniques to slow down runoff, allow it to soak into the ground, and filter out contaminants. The result is less volume and velocity of water added to local streams, increased groundwater recharge, and less pressure on municipal storm water infrastructure. Green lots also decrease the urban heat island effect, and may reduce habitat fragmentation and loss. The landscaping from green lots improves the air quality and aesthetic appeal of parking lots, and may even improve mental health. Green lots can even bring positive publicity to surrounding businesses. In combination with sustainable parking legislation, municipalities may be able to use land efficiently, get more tax dollars, and fight sprawl development patterns (American Rivers, 2004).

Many conservation design and eco-friendly storm water management techniques involve dealing with storm water runoff on-site. The idea is to reduce water leaving the site, and eliminate pollutants through bioengineering techniques that mimic native vegetation. We reviewed several manuals and guides to summarize some of the best management practices for green parking lots. The United States Environmental Protection Agency released the *Green Parking Lot Resource Guide* in 2008. The other four sources have local ties to Minnesota. American Rivers, a national non-profit, produced a natural storm water management manual specific to the Great Lakes Region. We referenced the *Minnesota Storm water Manual*, and several documents from the Minnesota Pollution Control Agency (MPCA) website. We also examined the *Minnetonka Water Resources Management Plan*.

The conservation techniques start with construction of parking lots. The goal is to minimize soils disturbance and exposure, stabilize slopes, and limit sediment-filled runoff. Silt fences and tarps are common industry techniques to keep exposed soils in place. An outline of sediment control plans should be included with a permit application to build a parking lot. In addition, web resources explaining techniques in depth will empower citizens in monitoring, and provide a useful resource for construction professionals. The MPCA has many links on their website that deal with best practices for storm water management (MPCA, 2013). For instance, Figure 2 shows how improperly managed construction sites are highly erodible. This figure is taken from a link on the MPCA that discussions a model ordinance for storm water, erosion, and sediment control.

Figure 2. Erosion Rates



There are alternative materials to asphalt in constructing parking lots. Porous pavement is one option. Porous pavers allow some water to infiltrate into the ground beneath them. A study conducted by Rushton (2001) found that porous pavement reduced run-off by 10-15%. Rushton also found that phosphorus, metals, and hydrocarbon levels were higher in basins adjacent to asphalt parking lots than those adjacent to parking lots paved with porous pavement or cement.

There are many techniques that can be used to store and infiltrate water on site, including rain gardens, filter strips, swales, and detention basins. Rain gardens are sunken gardens designed to catch runoff. In the same manner, filter strips are narrow vegetative buffers that will filter runoff. Swales are grassy channels or depressions designed to catch storm water. Swales can be dry or wet, meaning that they can permanently hold water or only hold in when there is precipitation. Rushton (2001) found that swales reduced runoff by 30% at her study site. Detention basins are ponds that hold storm water. However, they are not as efficient as the other techniques for filtering out pollutants. The *Minnesota Storm water Manual* (2008) goes into extensive detail about each of these design techniques. The manual has even been converted into a Wiki so that the cumbersome pdf does not even have to be downloaded by developers. Appendix A also summarizes these techniques in a table. We will not go into detail of each of the conservation design techniques, but will provide some examples of their use in Minnesota.

The Maplewood Mall Retrofit project constructed in partnership with the Ramsey-Washington Metro Watershed District is a good example of storm water BMPS. The parking lot for the Maplewood Mall was outfitted with rain gardens, lines of trees over trenches capable of holding water, porous pavement, vegetated filter strips, and a cistern. Figure 3 shows a picture of an area of the parking lot before and after the retrofit project. Interpretive signs educate retail customers about the project, and were a positive publicity campaign for the mall.

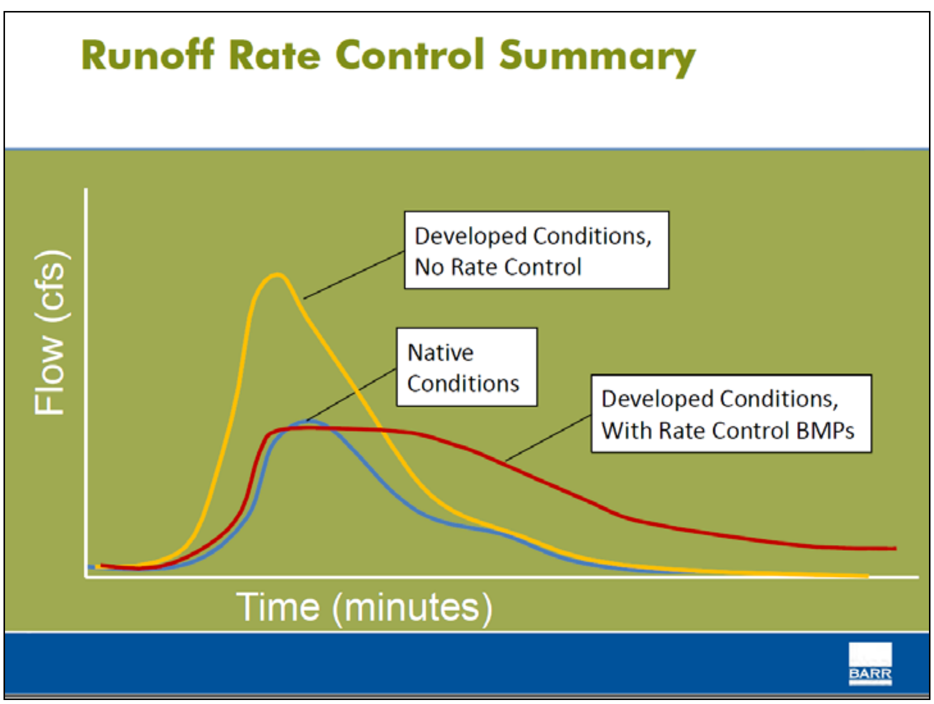
Figure 3. Maplewood Mall Parking Lot Before and After Conservation Design Techniques

In addition, the design of the spaces can reduce the size of the impervious surface of the parking lot. Reducing stall dimensions and creating multi-level garages can be a way to get more spaces into a smaller area. Multi-level garages and fenced borders for parking lots are aesthetic changes that both reduce impervious surface areas of parking lots and make parking lots more pleasing to view.

Cook (2007) recommends thinking of green parking lot design techniques holistically, and using them in conjunction with other storm water management best practices to be the most effective. Native plants in landscaping will require less water and maintenance than exotic varieties. Green roofs will reduce water runoff from buildings that run onto parking lots. Salt, fertilizers, and pesticides should be used sparingly and with care. Vegetated buffers around shorelines and wetlands conservation will keep natural filtering systems in the landscape to deal with runoff from parking lots and other impervious surfaces (MPCA, 2008). Finally, litter control and regular sweeping of the parking lot will limit sediment input into runoff.

The bottom line is that conservation techniques for parking lot storm water management work. Figure 4 shows a comparison of runoff for native vegetation, development, and development with best management practices of conservation design. The BMPs allow the landscape to mimic native vegetation's ability to control runoff flows. Flows are reduced and spread out over time. This translates into greater flood protection, reduced need for storm water infrastructure, and costs savings for municipalities.

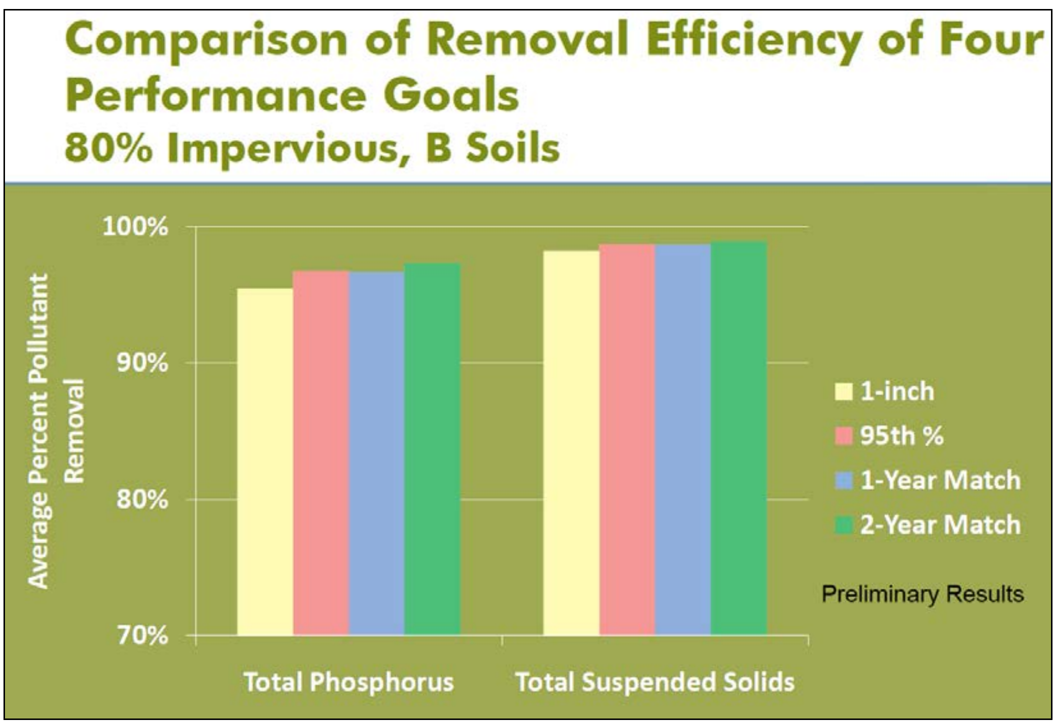
Figure 4. Runoff Rate Comparison



While the argument for using conservation design techniques in parking lot designs is clear, it is also required by law. The City of Minnetonka is required by federal law to comply with Municipal Separate Storm Sewer System (MS4) permits for managing non-point source storm water. Parking lots are a non-point source of storm water runoff. The *Minnetonka Water Resources Management Plan* was approved in 2009 in accordance with Minnesota Statute 103B.235 and Minnesota Rules 8410 to fulfill MS4 requirements, and we discuss specific details in the next section.

Minimal impact design standards (MIDS) set performance goals for parking lots. For instance, there may be requirements for storm water runoff rates, volumes, and pollutants. Examples of MIDs include a requirement runoff retention volume to one inch of water that would cover the area of impervious surfaces, or a runoff retention volume equal to the volume produced by the site during a 95th percentile storm, or a runoff retention volume equal to the infiltration rate of native vegetation for a one or two year rain event of 24-hours. Figure 5 shows how these different strategies can be simulated for their effects on pollution control. MIDS do not specify a particular layout for parking lots, but instead focus on the water retention goals for a specific site. It gives flexibility to developers in how to achieve these results (US-EPA, 2008).

Figure 5. Performance Goal Efficiency



Minnetonka and Neighboring Communities

Minnetonka has an established set of parking regulations. These regulations allow plenty of parking for the residents. The parking ordinances should reflect this goal of the city. Minnetonka provides free parking throughout the city. The city hopes to better utilize parking spaces and cut down in areas that have underused lots. Minnetonka promotes green and open space. The uses of conservation design techniques for storm water management are desirable and required. There also needs to be a focus on multimodal transportation to promote the use of bikes and walking around community areas. Designs should be used as a tool to promote open space, apply parking regulations and multimodal uses.

Today we see Minnetonka facing some challenges with parking. There needs to be a better system to regulate the amount of parking spaces allocated for different land uses. There are places where the city could create a better use of space with redesigning different parking lots, such as around Ridgedale Mall. It is important to be cautious with the placement of some of the regulations so there will not be an overflow of parking into the neighborhoods. Minnetonka could benefit from setting strong regulations for shared parking. Minnetonka could also base their parking off of the average parking demand. Drawing ideas from neighboring communities will help evaluate what other areas are doing with their parking and to see that is working well.

Some regulations that Minnetonka currently uses are not utilizing parking in the best way. Within the parking requirements subdivision 12, section A, number 4 hints at the use of shared parking. These are good standards, but could be addressed in ways such as a surface parking tax as suggested in earlier literature. These are just some ideas for future consideration. Minnetonka also does not allow pervious parking surfaces and has strict minimum parking requirements. There are a few places within the parking regulations that could be changed to better impact the parking concerns for the city instead of adding additional new ordinances.

The *Minnetonka Water Resource Management Plan* does outline some good requirements, including construction site runoff control, pollution prevention, and storm water management in developed areas. Runoff rate is limited to "peak runoff flow rates to that from existing conditions for the 2-, 10-, and 100-year storm events". Runoff volume must be dealt with on-site for all impervious surfaces to a depth of one inch. Runoff must also "be treated to at least 60 percent annual removal efficiency for total phosphorus and 90 percent total annual removal efficiency for total suspended solids" (City of Minnetonka, 2009). These are decent base MID performance goals.

Hopkins

The City of Hopkins has similar parking regulations to the City of Minnetonka. The city is comparable to Minnetonka because it is also a suburban area and the two cities share a border. The City of Hopkins is currently working on a LRT stop that is located very close to the Minnetonka boarder. This stop will allow Hopkins and Minnetonka to work together on issues relating to this stop and one foreseeable problem will allocation of parking for this stop. This should be taken into considerations when implementing new and current parking ordinances. Hopkins offers a few different ideas that vary from Minnetonka on parking.

Hopkins being so similar to Minnetonka has fairly similar regulations. However, some of the differences could make big impacts within Minnetonka. Hopkins offers shared parking based on primary times for different uses. This allows different uses to share the same parking lot as long as they have different peak hours. This is a great way to utilize parking areas. Hopkins also participates in limited lot permits. These are neighborhood permits that are allocated to resident and can be used for monthly, quarterly, or yearly time periods. Both of these policies work well for the City of Hopkins. These policies could also be utilized by Minnetonka to better utilize parking spaces and manage off street parking in neighborhoods.

Golden Valley

Golden Valley is located to the northeast to the City of Minnetonka. These two cities are comparable and have very similar parking regulations. Golden Valley has a stretch of commercial uses along its south border. The city overall is made up of mostly low density residential. Golden Valley offers some very similar ordinances to Minnetonka with only a few notable exceptions.

Golden Valley has one major difference. Golden Valley offers residential parking regulations in some areas. They have regulations in their parking ordinances to rule certain areas as residential parking only. With this system they offer residents parking permits. They also have a residential parking permit authority to enforce these regulations. This permit authority enforces fee and tickets for violations. This could lessen the impact of parking in neighborhoods. This is an option Minnetonka could consider implementing.

Wayzata

Lastly, the City of Wayzata shows a different way of enforcing parking. The City of Wayzata is another suburb located near Minnetonka. This city is uniquely shaped and offers many amenities for its residents. Wayzata is a mostly low density residential with a few commercial areas. The city relies heavily on the automobile and roads as a main form of transportation.

Wayzata has very limited regulations. The regulations in place are broad and can range over many situations. They have a regulation that enforces parking devices. This rule establishes the power to maintain and regulate parking devices. It also give the city the power to implement parking devices if necessary. Unfortunately, there are no suggestions for what these devices can be used for. It can be inferred that these devices are meant to for such things as parking meters, and parking time enforcement. It seems that Wayzata has a very relaxed set of policies to regulate parking, suggesting they do not have many parking issues or don't see the need to make any changes.

Takeaway

Overall, there are a few key takeaway points from examining neighboring cities. By looking at three neighboring cities, this provides a better framing for the type of areas located around Minnetonka. It also gives ideas about some innovative ideas that Minnetonka could use to improve their parking issues. Some strengths the City of Minnetonka has already in their parking regulations are:

- Allows some shared parking under certain restrictions
- Regulations on bicycle parking
- Runoff flow, volume, and pollutant thresholds.

These are areas where the regulations are strong. These strengths often follow many of the regulations from other cities.

After comparing regulations from other cities there are a few regulations that the City of Minnetonka could improve on. These weaknesses include stronger regulations to achieve the cities goals. There are also some areas that are missing and by adding new ordinances, Minnetonka would decrease some of the parking issues at hand. Some missing components or regulations for Minnetonka are:

- Combining a mix of land uses that allows and encourages shared parking areas
- Residential parking regulations based on time zones
- Residential parking permits and enforcement.
- Greater requirements of conservation design techniques to manage storm water.

These weaknesses are very general. They are taken just from comparing the Minnetonka parking ordinances to their neighboring cities. These ordinances are not the only thing that manages parking. For example, placing different land uses strategically together can increase shared parking. It is also important to look at all aspects and effects of parking when implementing policies, such as environmental concerns, multimodal development and economic centers in a city. These all affect the way parking spaces are used and where the regulations are implemented. This makes parking ordinances very place specific and hard to set on a broad standardized basis.

Discussion

Minnetonka, like all cities, has individual design characteristics and values that differentiate it from its surrounding areas. Therefore, a municipal wide parking ordinance that works for Hopkins might not necessarily be efficient for Minnetonka. With that said, we do not wish repeat previous designs in regards to Minnetonka, rather we wish to create a unique re-design that meets the city's goals by playing off of its strengths and by turning its weaknesses, in terms of parking, into advantages. Here, we wish to sum up the aforementioned ideas, examples, and suggestions listed in this report and provide a concrete list of recommendations specific for the City of Minnetonka.

Figures 6, 7, and 8 show ideas for the Ridgedale Center parking lot. There could be storm water BMPs of rain gardens and bio swales. In terms of design changes, in order to decrease surface-level parking surrounding such expansive lots such as the Ridgedale Center and the Best Buy lot, the city should look to implement stacked parking. This could be done in the form of a parking deck or in the form of underground parking. In both cases, the parking area is much denser and provides for additional space that could be used or a variety of things such as open green space or pedestrian and bike trails. With both structure types it is possible to design a green roof to reduce rainwater runoff as well as reducing the urban heat island effect. In the case of parking decks it is also feasible to apply a vertical garden to the structure, reducing the heat island while at the same time making the deck much more aesthetically pleasing.

The previously mentioned open space and pedestrian infrastructure that could be accommodated by this design could also lead to alternative transportation choices to these areas, thus decreasing the demand for parking spaces. The city could encourage private development to implement structured parking by taxing surface lots. This internalizes costs while also incentivizing developers to construct more environmentally sustainable parking facilities. This later part is only possible if parking is taxed by surface area rather than by space, and as we stated in our literature review, this system would only be possible if minimum parking requirements were completely annulled.

To deal with equity issues in term of parking finance, businesses in the Ridgedale shopping center, and elsewhere, would have the option of paying an in-lieu fee to either finance a shared parking structure or pay funds that would go directly to the community. If the cost of parking is being directed back into the City of Minnetonka, this prevents individuals who choose more sustainable modes of transportation from being overcharged for parking. This also avoids the political shortfalls associated with charging individuals directly for parking. We do not think that charging users directly for parking in Minnetonka would be neither efficient nor politically feasible.

In our literature review, we detailed the negative external effects that parking lots have on the natural environment. This obviously applies to Minnetonka as well. Since it is likely that regardless of whatever parking policy changes Minnetonka chooses to implement in the future there will still be a number of surface level parking lots. In order to soften the environmental blow that these lots have on the environment there are certain design measures that can be taken in response. Minnetonka can require all parking lots to be built with a more porous pavement that allows a greater amount of storm water to be soaked into the ground in contrast to traditional pavement which is impervious. Requirements can also be made to include vegetative filter strips adjacent to all developed parking lots. These allow the collection of sediment and would result in less contaminated run-off water. These are just a couple of the best practices that Minnetonka could require in the building on surface level parking areas. Several others are listed above in the section titled conservation design.

Figure 6. Ridgedale Center Aerial

Conclusion

From all of this we found 8 applicable changes in ordinances that should be implemented for the City of Minnetonka. These are suggestions that we have developed from the research and discussion of different aspects of parking issues.

Ordinances

I. Do away with the minimum-parking ordinance.

Businesses to adapt with an alternative payment method that would filter money back into the community. This would easily work with many different types of business that have a location for which many of their customers are reaching them via biking or walking.

II. Offer alternative infrastructure.

Business should be encouraged to offer accommodations for all types of modes of transportation such as bike racks or pedestrian trails. It would promote public transportation and could limit the surface parking areas.

III. Allow mixed-use or high-density developments that are located within close proximity to the forthcoming light-rail stations.

By coordinating land uses of residential and transportation, this can promote the use of public transit. One option could be to offer reduced rent to non-drivers or people who would not be using and parking spaces. This would need some further research with implementing this strategy into the housing and zoning regulations.

IV. Increase minimal impact design standards (MIDS) for parking lots with adaptive management options if water quality decreases

MIDS do not specify a particular layout for parking lots, but instead focus on the water retention goals for a specific site. It gives flexibility to developers in how to achieve these results. Minnetonka could increase its standards using adaptive management techniques. For instance, pollutant percentage removal requirements could be increased in stream quality degrades.

V. Maintain aesthetic regulation for parking lots

Setting aesthetic regulations would allow parking to blend into the community better. It would create a better sense of place for different neighborhoods. These aesthetic regulations could be something like a parking deck or underground parking. It could even be a fence or public art requirement to make parking lots still contribute to the livability and identity of the community.

VI. Offer greater incentives for conservation design techniques within all pervious surfaces

Minnetonka can make a greater effort to encourage techniques such as rain gardens, filter strips, and green roofs that manage run-off on site and reduce the amount of polluted storm water. The current cost share program for storm water BMPs can be expanded by the city. Conservation design techniques should become the standard, not the exception.

VII. Businesses that have different peak business hours should use share parking.

Allow businesses that have different peak business hours to share parking spaces. This could allow the businesses to pool the money that is being saved from building extra spaces to use it to promote mixed-use parking facilities. The City of Minnetonka already promotes some shared parking standards but, they need to be stronger and encourages were ever there is a mix of business types in the same facility.

VIII. Expand developer and public outreach and education campaigns.

Public outreach will garner support from citizens for measures that support conservation design techniques and storm water BMPs in Minnetonka parking lots. Businesses who adopt these measures deserve media attention for their efforts. Public outreach will ensure green parking lots become the normal standard, and not just exceptions. Developer education will give construction professionals the tools to respond to public demand for sustainable design measures.

Parking lots are necessities for our largely automotive transportation system. However, parking lots have many negative consequences on water quality, air quality, habitat quality, human health, and community livability. Our proposed zoning ordinance will help Minnetonka mitigate some of these concerns. They should be adapted in a way that fit to community. All of the suggestions are aimed to address different issues parking lots bring about. From the research and critical analysis of both the Minnetonka ordinances and neighboring communities we have found many options and applications for solutions. The ordinances suggested very applicable to the city and should be taken into consideration for implementation.

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Figure Sources

Figure 1: Google Maps.
Figure 2: MPCA.
Figure 3: Ramsey-Washington Metro Watershed District.
Figure 4: Barr Engineering.
Figure 5: Barr Engineering.
Figure 6: City of Minnetonka.

Appendix

Appendix A. Storm Water Management Matrix

Source: American Rivers, 2004

Stormwater Management Matrix

Stormwater management techniques are often categorized by a particular attribute they possess. For example filter strips are generally placed in the category of filtration methods. However natural stormwater management methods often have similar attributes and can be difficult to categorize because they overlap numerous categories. The matrix below lists the different methods in the order they appear in this guide, and associates them with their most common uses.

Definitions

On-site *- smaller methods that collect and handle stormwater at a centralized location. They handle small drainage areas.*
Reception site *- methods that collect and deal with stormwater from various sources and service larger drainage areas*
Individual Homes *- Methods that work best for houses or small buildings.*
Neighborhoods *- Methods that work better serving collections of houses or larger buildings.*
Infiltration *- Method facilitates water into the soil and groundwater*
Filtration *- Method helps remove sediments and pollutants*
Retention *- Method that retains water for long periods of time or has a permanent supply of water*
Detention *- Method slows water down but does not permanently retain any water.*

A box left blank means that method does not fall into that category.

○ *- Method fits into this category only partially or through special design.*

● *- Method fits well in this category.*

Category / Method	On-Site	Reception site	Individual Homes	Neighborhoods	Infiltration	Filtration	Retention	Detention
Bioretention	●	●	●	●	●	●	○	●
Rain Gardens	●		●	●	●	●	○	●
Dry Swales	●		○	●		●		●
Wet Swales	●		○	●	○	●	○	●
Filter Strips	●		●	●		●		●
Urban Stream Buffers	●			●	○	●		●
Urban Trees	●		●	●	●			●
Infiltration Basins		●		●	●	●		●
Constructed Wetlands		●		●		●	●	
Green Roofs	●		●					●
Rain Barrels	●		●				●	
Dry Wells	●		●		●		●	
Porous Pavement	●		●	○				●