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ENERGY WATER INFORMATION GOVERNMENT

Lawrence, Kansas
Wakarusa Water Reclamation Facility

B&V Project 138753
B&V File D-1.1
July 7, 2006

Ms. Debbie Van Saun
City of Lawrence
P.O. Box 708
Lawrence, KS 66044

Subject: Draft Wakarusa WRF Study Report

Dear Debbie:

Please find attached a copy of the *Draft Wakarusa Water Reclamation Facility Report* for your review. This report documents the public process, cost evaluations and site investigations utilized to provide a recommendation for the new Wakarusa Water Reclamation Facility. A second volume, *Draft Wakarusa Water Reclamation Facility Site Investigation Reports*, is included to provide further detail on the results of the site evaluations performed on both the "white" and "purple" sites.

Black & Veatch will be in Lawrence on Monday, July 10 to meet with the City and provide an overview of the report's findings. We look forward to the opportunity to discuss this portion of the project with you.

Please contact Mike Orth (913) 458-3473 or myself (913) 458-3474 with any questions you may have.

Very truly yours,

BLACK & VEATCH CORPORATION

John A Keller

John A. Keller
Project Manager

psb
Enclosures

cc: Mr. Dave Corliss, City of Lawrence, w/enclosures
Mr. Dave Wagner, City of Lawrence, w/enclosures
Ms. Lisa Patterson, City of Lawrence, w/enclosures
Mr. Philip Ciesielski, City of Lawrence, w/enclosures
Mr. Dan Warner, City of Lawrence, w/enclosures

Wakarusa Water Reclamation Facility Study
Executive Summary

This study was initiated by the City Commission to evaluate and determine the optimum location to construct a new water reclamation facility along the Wakarusa River, south of Lawrence, to meet current and future wastewater treatment needs in accordance with the *2003 Lawrence Wastewater Master Plan*. This study focused on the short-term needs of the City but also envisioned the build-out of the watersheds south of the Wakarusa River. This long-range planning led to the determination to acquire sufficient property to allow the City to eventually construct up to 50 million gallons per day (mgd) of treatment capacity at the selected site. The initial facilities will be able to treat 7 mgd, which, in combination with the City's existing wastewater treatment plant, will accommodate a population basis of 150,000. The results of the Wakarusa Water Reclamation Facility (WRF) Study recommend the new facility be located at a site located generally north of N 1100 Road and east of E 1600 Road. This recommendation is based upon an extensive public outreach and involvement campaign, specific on-site investigations, economic evaluations, as well as the capacity of the existing wastewater collection and treatment system.

Background

Leaders representing varied interests within the Lawrence community were invited to form the Public Advisory Committee (PAC), whose purpose was to aid in the determination of the priorities for the new facility location. The PAC was asked to deal with the following aspects of siting the new WRF: public acceptability factors, aesthetic fit with site location, and potential public site utilization. Through a series of PAC workshops, and confirmed through various meetings of the general public, the following criteria were deemed among the most important to consider in the siting of the WRF:

- Odor Control
- Stream Impacts
- Fit with Future Land Use
- Maximize Use of Existing Infrastructure
- Service Area by Gravity.

Seven sites were investigated as illustrated on the attached map. These sites were identified as viable due to their topography, usability, ability to receive gravity flow, and capability to connect with utilities such as water, power, natural gas, as well as necessary transportation routes.

Site Criteria Comparison

Each of the site and process footprint alternative combinations was ranked by the PAC/City staff according to the criteria and 20-year present worth costs were developed for each combination. The comparison considered construction and operation and maintenance (O&M) costs as well as the ability of a given site to meet the criteria developed by the PAC and City staff. The purple and white sites emerged as the highest ranking locations for further investigation, providing the highest value for the lowest cost. The attached figure shows the results of the present worth benefit analysis showing white and purple as the highest value sites. The City wished to advance these two potential sites for further investigation to ensure that a viable alternative would exist should a "fatal flaw" surface during the onsite investigations. Following a presentation of the PAC/City staff recommendations, the City Commissioners authorized the notification of property owners and the on-site investigations of both the white and purple sites commenced.

On-Site Investigations - Purple and White Sites

The following table summarizes the major findings of the on-site investigations:

Investigation	White Site Findings	Purple Site Findings
Phase I Environmental	• No significant findings • Debris removal required • Link to full report	• No significant findings • Debris removal required • Link to full report
Phase II Cultural Resources	• No archeological or architectural finds deemed eligible for National Register of Historic Places (NRHP) • Link to full report	• No archeological or architectural finds deemed eligible for NRHP • Link to full report
Jurisdictional Wetland Determination	• Jurisdiction stream and small wetlands in southeast corner of proposed facility plan • Plant footprint layout can mitigate • Link to full report	• COE to decide if ditch that runs along eastern border of facility plan is jurisdictional • If yes, plant footprint layout can mitigate • Link to full report
Boundary Survey	• Link to figure	• Link to figure
Geotechnical	• Not a significant differentiator – fat clay to ~20 feet and bedrock at ~52 foot depth • Link to report	• Not a significant differentiator – fat clay to ~20 feet and bedrock at ~58 foot depth • Link to report
Appraisal	• Lower total land cost • No residences to relocate	• Greater total land cost • Two residences to potentially relocate

Treatment Alternatives

In addition to numerous site locations, the PAC also considered various treatment alternatives categorized as small, medium, and large. A small facility utilizes a high-end technology such as membranes to reduce facility footprint. The medium facility is similar to that of the existing Kansas River Wastewater Treatment Plant. A large footprint takes the footprint of a medium facility and adds outdoor treatment wetlands for polishing. The wetlands treatment option required too much land to be considered on a full scale and was eliminated, except as a potential public amenity feature. It was determined that the cost of the small footprint alternative would be approximately $5M to $10M more, depending on site location, than the medium footprint facility on a capital cost basis. Present worth costs over a 20-year life of the project expanded the gap between the small and medium footprint options to a range of approximately $25M to $30M. Further information on the process footprint alternatives considered may be found in the memorandum, *Overview of Alternatives*.

Conclusions Based on Findings

The on-site investigations did not identify any "fatal flaws" on either site. The appraisals determined that nominally 500 acres could be purchased at the white location for less than the purchase of slightly over 300 acres at the purple location.

Aside from the increased cost in land acquisition, the purple site is not the optimal location due to several physical site characteristics. There are established residences in close proximity to the site and it is bisected by Highway 458; in order to fit the facility on the site, a higher cost, small footprint facility would likely be required to address public acceptability of this facility at the southern gateway to the City. In addition, the purple site has two residences that would require relocation as well as several near-neighbors that may be impacted. The topography to the south and east also rises with established residences on the hills that would overlook the proposed facilities which would have negative public implications. These impediments reduce the flexibility and usability of the purple site, leading to less optimal design possibilities, higher project costs, as well as potential schedule implications. Another significant factor is the proximity of existing development to the northeast in the direction of prevailing winds that may carry any odors from the facility directly over a greater population density than the white site.

Of the sites investigated, the white site best fulfills a combination of the above criteria, as well as other factors identified by staff, PAC, and the public. Nestled within the floodplain of the Wakarusa River, the white site is bordered on the north and east by floodway, a natural barrier from current public areas as well as future development. As a result, the location of a water reclamation facility within the white site provides a good fit with current land use and future land use projections of vacant/farming activities due to its floodplain location. In addition, fewer neighbors are currently located in close-proximity to the potential facility than in other areas considered; no residences would need to be relocated to construct the facility within the white site. With its location to the southeast of central Lawrence, the white site minimizes the potential that odors carried to the northeast by prevailing winds would impact the portions of Lawrence with significant population densities. The white site is also well-positioned between critical facilities, such as Four Seasons Pump Station and the existing Kansas River Wastewater Treatment Plant, allowing the use of existing infrastructure to be maximized.

In addition to the criteria discussed above, the white site was also investigated for the potential that the proposed South Lawrence Trafficway (SLT) could be located along the 42nd Street Alignment, cutting across the southeast portion of the white site. It was determined that the proposed site was flexible and neutral to the possibility that a portion of the SLT could be located on the site.

Recommendation

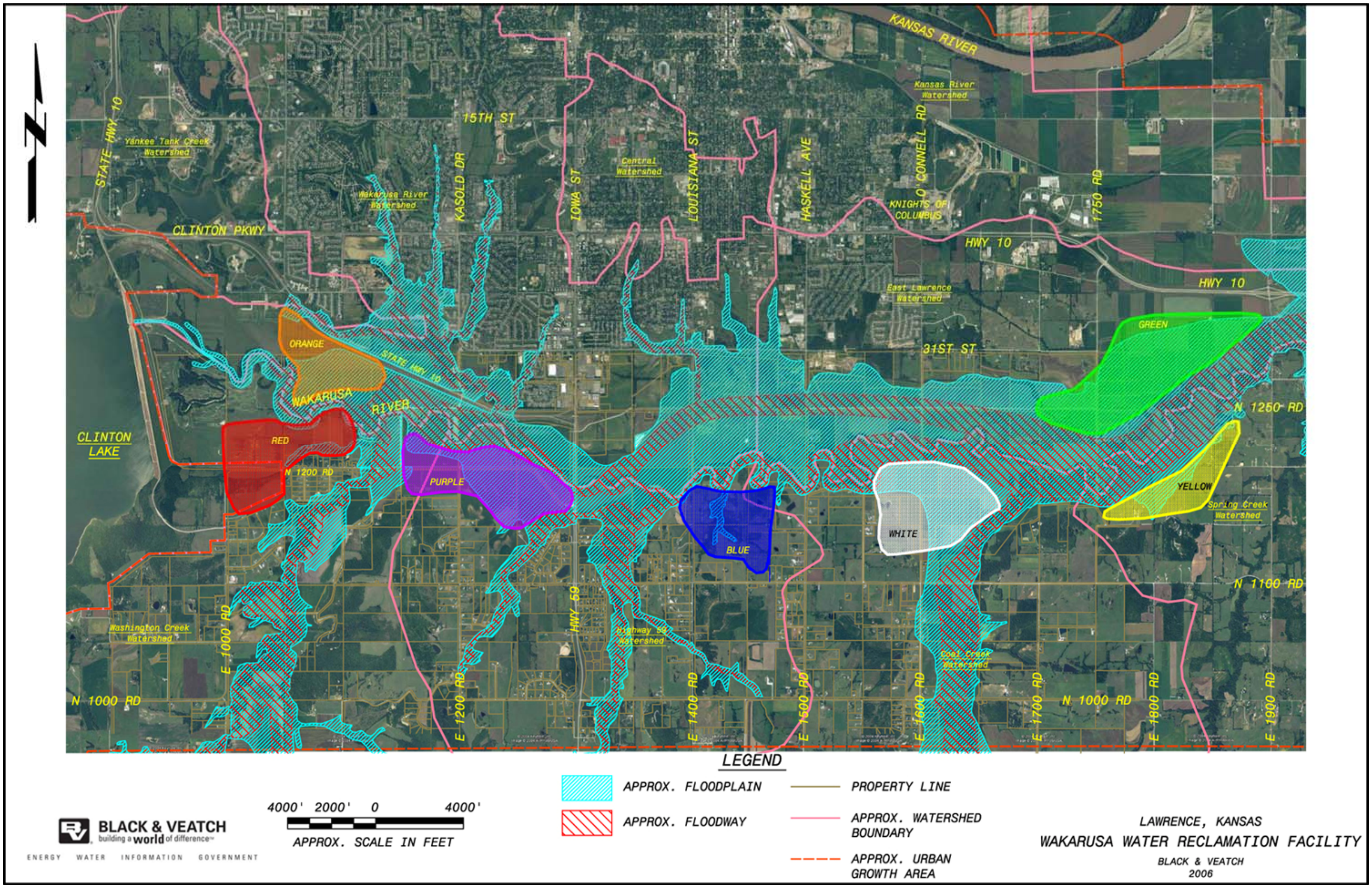
The white site has a number of attributes which make it the most desirable location upon which to construct the currently proposed facility and expansions, including the site's:

- relative isolation from existing and future development
- location outside of a gateway to the City and downstream of the Haskell-Baker Wetlands
- impact on fewer property owners during acquisition and no residences to acquire
- favorable location with respect to odors potentially carried by prevailing winds
- lack of restrictions provide increased flexibility to accommodate varied process footprints
- absence of fatal flaws revealed by on-site investigations
- central location with regard to existing infrastructure
- neutral to the location of the SLT.

In addition to the factors listed above, the cost of constructing and operating a facility on the white site also compares favorably with other sites investigated. With a reduced land acquisition cost and potentially lower costs for odor control and aesthetic treatment, the white site provides the greatest value per unit cost.

Based on the criteria development and assessment completed by the PAC group, staff, consultants, and the results of the on-site investigations and financial analysis, the white site is the optimal location for the new Wakarusa WRF. The medium "conventional" footprint treatment process is recommended at the white site due to the amount of land potentially available providing a large buffer from adjacent residences. Therefore, it is recommended that the City of Lawrence pursue the acquisition of the white site for construction of the Wakarusa WRF.

The complete study report may be accessed at the following link: Complete Report.


KANSAS RIVER
Kansas River Watershed
15TH ST
STATE HWY 10
Yankee Tank Creek Watershed
Wakarusa River Watershed
KASOLD DR
IOWA ST
Central Watershed
LOUISIANA ST
HASKELL AVE
O'CONNELL RD
KNIGHTS OF COLUMBUS
1750 RD
CLINTON PKWY
HWY 10
East Lawrence Watershed
31ST ST
ORANGE
GREEN
STATE HWY 10
WAKARUSA
RIVER
N 1250 RD
CLINTON LAKE
RED
N 1200 RD
PURPLE
BLUE
WHITE
YELLOW
Spring Creek Watershed
N 1100 RD
Washington Creek Watershed
E 1000 RD
HWY 59
Highway 59 Watershed
Coal Creek Watershed
N 1000 RD
E 1200 RD
E 1400 RD
E 1500 RD
E 1600 RD
E 1700 RD
N 1000 RD
E 1800 RD
E 1900 RD
LEGEND
APPROX. FLOODPLAIN
APPROX. FLOODWAY
PROPERTY LINE
APPROX. WATERSHED BOUNDARY
APPROX. URBAN GROWTH AREA
4000' 2000' 0 4000'
APPROX. SCALE IN FEET
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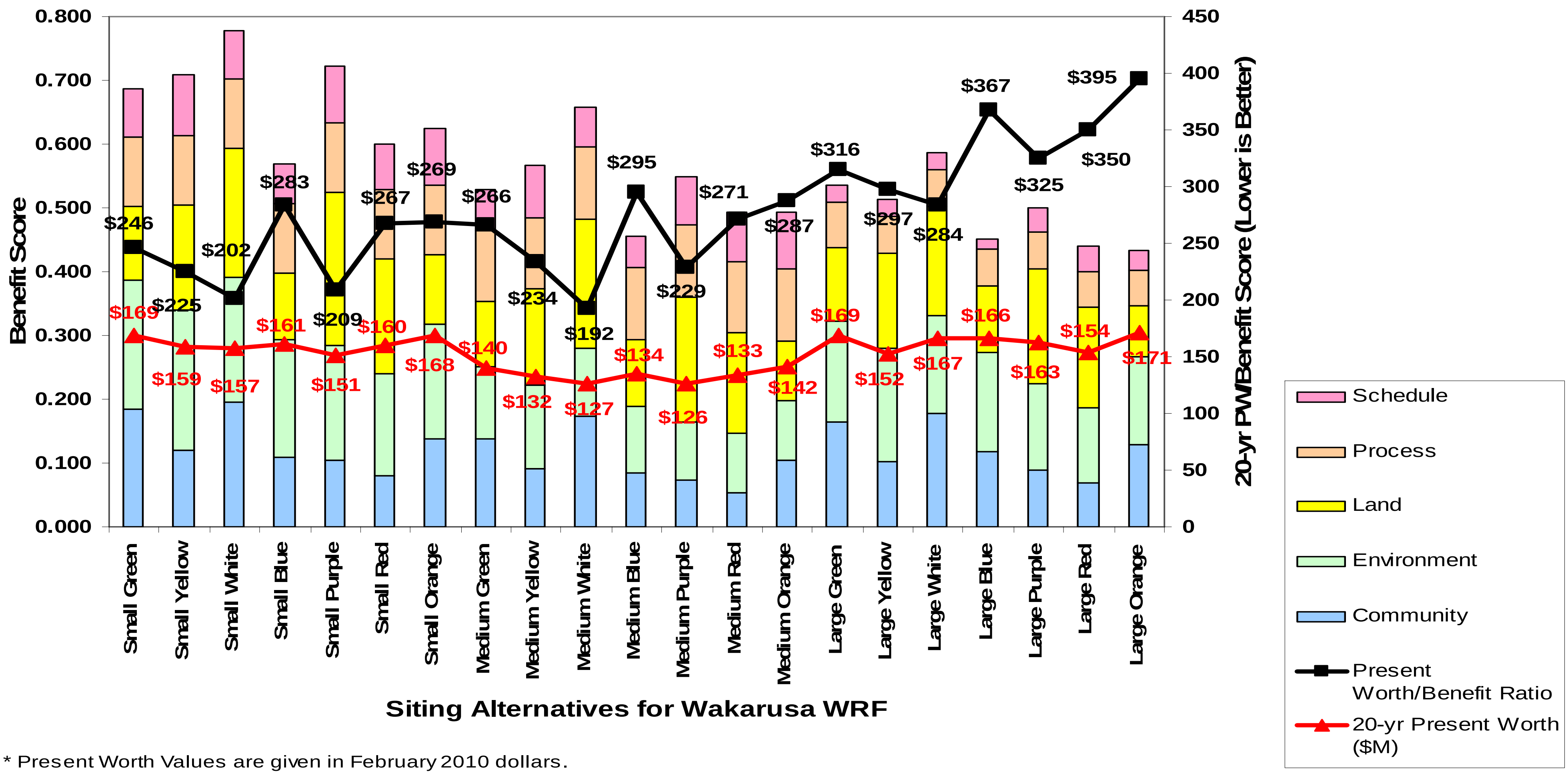
2006

Contribution by Primary Criteria - 20-year Present Worth*/Benefit



* Present Worth Values are given in February 2010 dollars.

I. Purpose

The purpose of this project is to conduct an evaluation to determine viable locations for a future water reclamation facility (WRF) to serve the western and southern portions of the City of Lawrence's planned Urban Growth Area (UGA). The treatment facility options were planned and sized to meet the land and facility requirements for ultimate build-out of the watersheds identified in the 2003 Wastewater Master Plan Study. Viable treatment facility locations were identified, screened, and evaluated in order to determine the most suitable location meeting the stakeholders' goals for the future facility. This summary report is provided to the governing body for decision-making purposes.

II. Public Outreach

Encouraging public participation and input was a significant driver behind the goals of the Wakarusa WRF Study. All aspects of the project process were designed to allow interested citizens the opportunity to become informed on the goals and direction of the project, as well as to provide their input into the decision-making process. Two broad citizen groups were considered during the Wakarusa WRF project - the Public Advisory Committee (PAC) and the interested citizens-at-large.

A. Public Advisory Committee Role

The PAC Group consisted of various individuals representing entities or community organizations that have a focused area of interest regarding the siting of the Wakarusa WRF. This group of 20 individuals was selected through discussions with the City. Invitations for their participation were extended by the Mayor. The PAC Group members and the organizations represented are listed as follows:

- Mr. Charles Jones
Douglas County - Board of County Commissioners
Chairman, 1st District Commissioner
- Ms. Carrie Lindsey
League of Women Voters
Lawrence/Douglas County President
- Mr. Roger Pine
State of Kansas Senate
3rd District Senator/Farmer
- Ms. Alison Reber
Kaw Valley Heritage Alliance
Kansas StreamLink Program
Executive Director
- Dr. Terry Riordan, MD
Lawrence/Douglas County Planning Commission
Chair
- Ms. Bobbie Flory
Lawrence Home Builders Association
Executive Director

- Mr. Tom Bracciano
  Lawrence Public Schools
  Facilities and Operations Planning
  Division Director
- Mr. Warren Corman
  University of Kansas - Business and Financial Planning
  University Architect
- Mr. Rod Geisler
  KDHE, Bureau of Water, Municipal Programs
  Chief
- Mr. Lavern Squier
  Lawrence Chamber of Commerce
  President and CEO
- Mr. Michael Campbell
  Kansas Sierra Club (Wakarusa Group)
  Chair
- Ms. Mary Lynn Stuart
  Lawrence Preservation Alliance
  Secretary
- Mr. Michael Caron
  Save the Wakarusa Wetlands
  President
- Ms. Laura Calwell
  Kansas Riverkeeper
  Friends of the Kaw
- Mr. Michael Almon
  Interested Citizen
- Mr. John Craft
  Neighbor to Kaw WWTP
- Mr. Charles Hawkins
  Haskell Indian Nations University
- Mr. Mike Rundle
  Lawrence City Commission
  Commissioner
- Mr. Mike Amyx
  Lawrence City Commission
  Vice-Mayor
- Mr. Mike Bowman
  Interested Citizen

The members of the PAC Group focused on the siting issues related to the ability to construct a facility somewhere in the area that is generally one mile north and south of the Wakarusa River from Clinton Dam to East 1950 Road. The combined PAC/City Staff group's input drove the project direction, including public acceptability factors, aesthetic fit with the site location, and potential site utilization with the general public. The major focus of this group was to advise the project team on what aspects would or would not be acceptable at a certain site from a public point of view.

The PAC actively participated in five meetings. Throughout these meetings, the PAC members were provided with project and process background. The PAC offered their input on the site selection criteria. The PAC also provided input into the rankings of the potential sites and facility footprint combinations against the selected criteria. Table 1, below, provides a summary of the timing of and topics covered for each of the PAC meetings. Meeting materials for each of the PAC Meetings may be found in Appendix A.

Table 1. Summary of PAC Meeting Topics.

PAC Meeting	Topics Covered
PAC Introduction 10/26/05 4:00 to 5:30 pm	• Review PAC roles and responsibilities • Discuss project and process overview/background
PAC Workshop #1 11/15/05 4:30 to 6:30 pm	• Follow-up on PAC questions from the Introductory Meeting • Review Stakeholder interview findings and Community Survey results from Public Meeting #1 • Discuss initial results of PAC, Staff, and Consultants to criteria survey
PAC Workshop #2 1/18/06 4:00 to 7:00 pm	• Review wetlands treatment options • Review updated criteria survey results • Define alternatives – capacity and footprint • Determine "community" and "environmental" rankings for each of the sites
PAC Workshop #3 2/15/06 4:00 to 7:00 pm	• Review revisions to "community" and "environmental" subcriteria • Determine "land, " "process, " and "schedule" subcriteria • Review content of Public Outreach program
PAC Eco-machine Discussion 3/1/06 4:00 to 6:00 pm	• Panel discussion on the suitability of Eco-machine technology in Lawrence • Formulate recommendation to City Commission on direction forward

B. Public Engagement

In addition to the utilization of the PAC group, citizens-at large were also encouraged to provide their input through two primary methods. Citizens-at large were invited to attend three public meetings through open invitations on the City's website and other press releases. The first two meetings covered general project and process information as well as a review of the PAC's criteria recommendations and rankings.

During the first public meeting, attendees were asked to respond to a short survey. The results of the survey indicate that a greater number of the respondents are willing to pay more in wastewater rates to allow the existence of a community amenity around the WRF. The top amenities indicated were:

- green space,
- wetlands,
- walking/bike trails.

Public concerns about the facility focused on:

- odor control,
- aesthetics/architectural character, and
- impact of truck traffic.

At the second public meeting, individuals were asked to comment on the list of important criteria for siting consideration that had been developed at the PAC workshops. Attendance at the first public meeting was fairly geographically diverse; attendance at the second public meeting was more specific to those that lived in the project study area. The third public meeting was held after notifications had been made to property owners whose property was contained within one of two selected potential siting locations. The results of the selection process and the content of Public Meeting No. 3 will be discussed in more detail later in this report. Meeting materials related to each of the public meetings may be found in Appendix B.

In addition to the public meetings, additional public input was gathered through a process of stakeholder interviews. In order to capture a diverse picture of the thoughts on the WRF, interview participants were of varied backgrounds, including elected officials, property owners, business owners, neighborhood representatives, environmental groups, higher education representatives, and Lawrence City staff. Thirty-five people were interviewed in twenty-five separate interviews conducted over a two- to three-week period. All interviewees were previously aware of the recommendation to build a second treatment facility within the Lawrence area. Interviewees also understood that Lawrence was growing faster than anticipated and might reach a population of 100,000 before 2011 as previously projected. The most frequently voiced concerns by the respondents were:

- protection of environmental and historical resources,
- odor control,
- aesthetics, and
- project fit with its surroundings.

The full interview summary report is given in Appendix C.

A comprehensive public outreach program including mailings, utility bill inserts, and the placement of informative kiosks throughout the community is being utilized to further disseminate information about this project. This public outreach campaign will continue throughout the conveyance corridor study and into the design and construction of the facility.

III. Capacity Evaluation

As evident from Figure 1, significant acreage within the watersheds that are touched by the UGA, actually fall outside the UGA boundaries. This additional future service area acreage represents the ultimate build-out scenario. Ultimate build-out should be considered when siting the Wakarusa WRF for long-range planning purposes. While treatment capacity is not currently needed for this area, the City of Lawrence desires to consider the spatial needs for the treatment facility to service this area in the future.

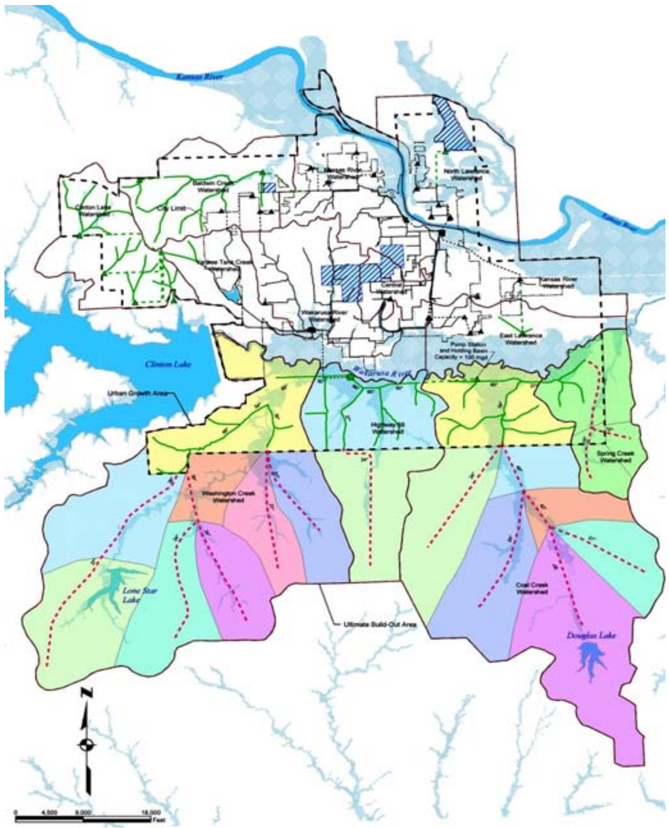


Figure 1. City of Lawrence Ultimate Build-Out Area

Various methods of determining the future wastewater flow from the full build-out area were investigated. Future land use plans indicate a greater residential than industrial development growth within the complete build-out area. Utilizing a 50-year planning horizon for the build-out acreage outside of the UGA, it was determined that the minimum treatment capacity required to service the build-out area, including areas within and outside of the UGA, is 50 mgd. More detail on the capacity evaluation may be found in the January 6, 2006 memorandum "Ultimate Build-Out Acreage," included in Appendix D of this report.

IV. Study Area Considered

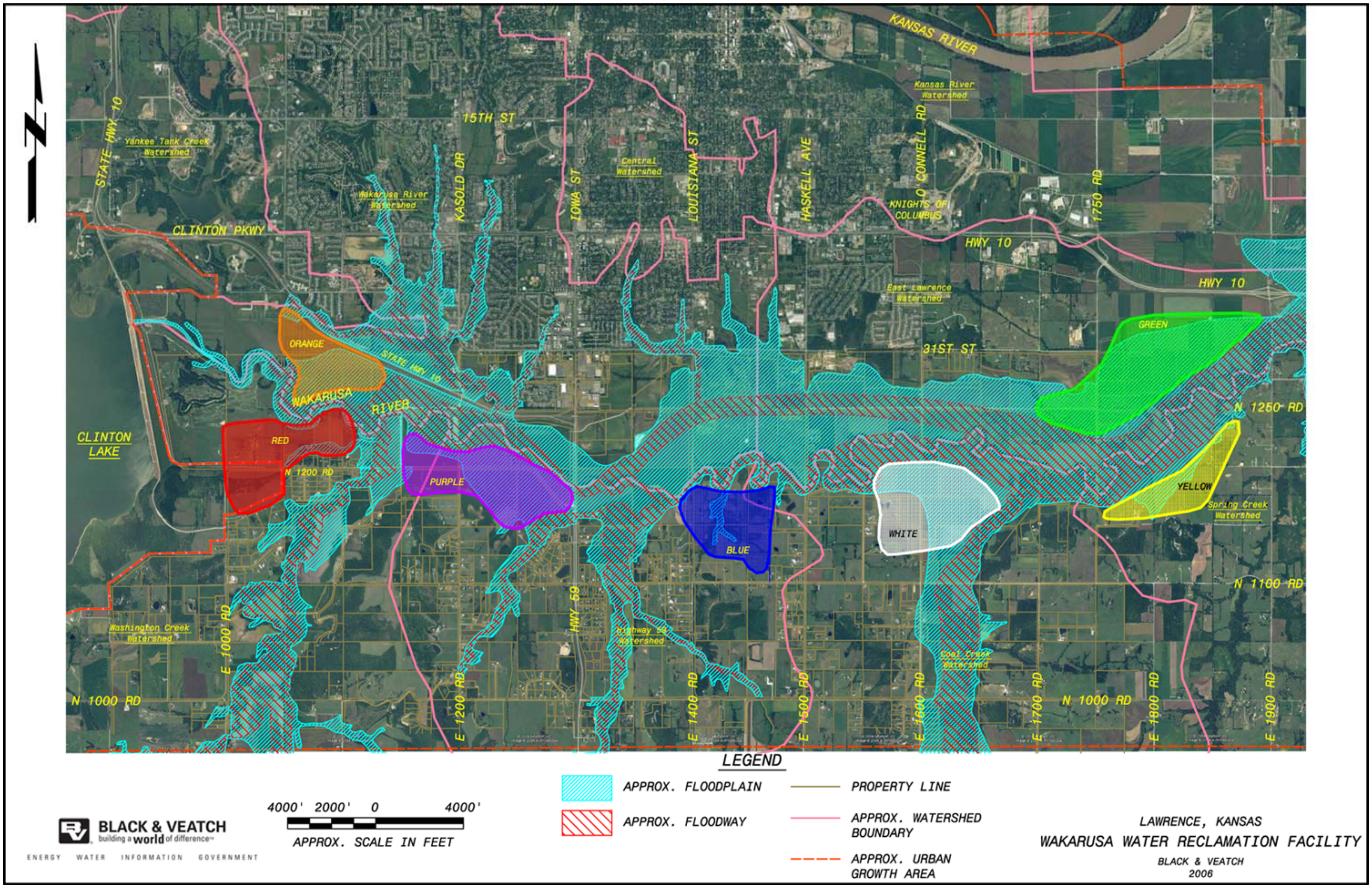
The study area considered for the siting of the Wakarusa WRF extends from roughly Clinton Dam on the west to E 1950 Rd. on the east and from approximately 1 mile north and south of the Wakarusa River. The west and east bounds of the study area were set by the bounds of the UGA. The northern and southern boundaries were set by proximity to the Wakarusa River in accordance with the recommendations of the 2003 Wastewater Master Plan. Within the current regulatory environment, the Master Plan found that building a new treatment facility to discharge into the Wakarusa River was a more economical method of providing additional treatment capacity than expanding the existing Kansas River Plant.

Consultants and City Staff drove the study area to view potential site areas identified by a desk-top study utilizing topographical and other mapping resources. Throughout the driving tour, the Staff and Consultants performed a visual screening of the potential sites. Various factors were considered during the screening process, including: location outside of the floodway, while maintaining a low elevation to allow maximum drainage by gravity, proximity of homes or historic buildings, and shape, size, topography, and usability of the site. By considering these factors, City Staff and Consultants were able to narrow the potential sites to eight general areas; further map work indicated that one of the sites was owned by KDOT for potential construction of a future South Lawrence Trafficway. This site was removed from consideration, leaving seven general remaining areas. These areas were randomly assigned color designations as shown on Figure 2, attached.

The PAC Members were invited to attend a bus tour of the seven general areas for potential consideration in siting the Wakarusa WRF. The tour route followed is outlined on Figure 2. PAC Member comments about each of the generalized areas were summarized in a memorandum. This bus tour memorandum was utilized by the Consulting team to assist in making the initial rankings of each of the sites against the selected criteria; this process will be discussed in more detail later in this document. A copy of this memorandum may be found as part of Appendix E.

V. Process Considerations

The main categories of process alternatives that will be considered for the Wakarusa WRF will be classified as **small, medium, and large** footprint technologies. Each of these categories of alternatives will be evaluated at each general site location. The **small** alternative will utilize small-footprint, high-end treatment processes to provide for a large volume of treatment capacity in a small footprint. The **medium** alternative will occupy the acreage required for a conventional mechanical plant, similar to Lawrence’s existing Kansas River Wastewater Treatment Plant (WWTP). The **large** alternative will combine the treatment technology represented by the medium footprint alternative, followed by polishing treatment utilizing an outdoor constructed wetlands. General process schematics of each of the process footprint option considered are given on the following page.



KANSAS RIVER
Kansas River Watershed
15TH ST
STATE HWY 10
Yankee Tank Creek Watershed
Wakarusa River Watershed
KASOLD DR
IOWA ST
Central Watershed
LOUISIANA ST
HASKELL AVE
O'CONNELL RD
KNIGHTS OF COLUMBUS
1750 RD
CLINTON PKWY
HWY 10
HWY 10
East Lawrence Watershed
31ST ST
GREEN
ORANGE
STATE HWY 10
WAKARUSA
RIVER
N 1250 RD
CLINTON LAKE
RED
N 1200 RD
PURPLE
BLUE
WHITE
YELLOW
Spring Creek Watershed
N 1100 RD
Washington Creek Watershed
E 1000 RD
HWY 59
Highway 59 Watershed
Coal Creek Watershed
N 1000 RD
E 1200 RD
E 1400 RD
E 1500 RD
E 1600 RD
E 1700 RD
N 1000 RD
E 1800 RD
E 1900 RD
LEGEND
APPROX. FLOODPLAIN
APPROX. FLOODWAY
PROPERTY LINE
APPROX. WATERSHED BOUNDARY
APPROX. URBAN GROWTH AREA
4000' 2000' 0 4000'
APPROX. SCALE IN FEET
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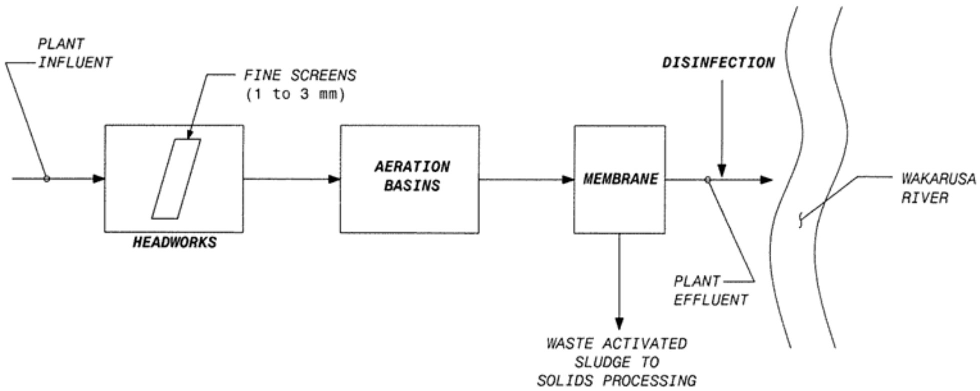
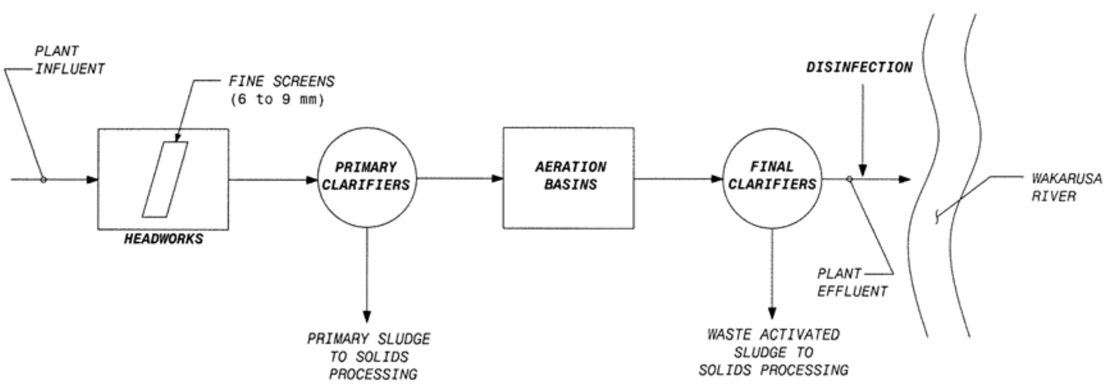
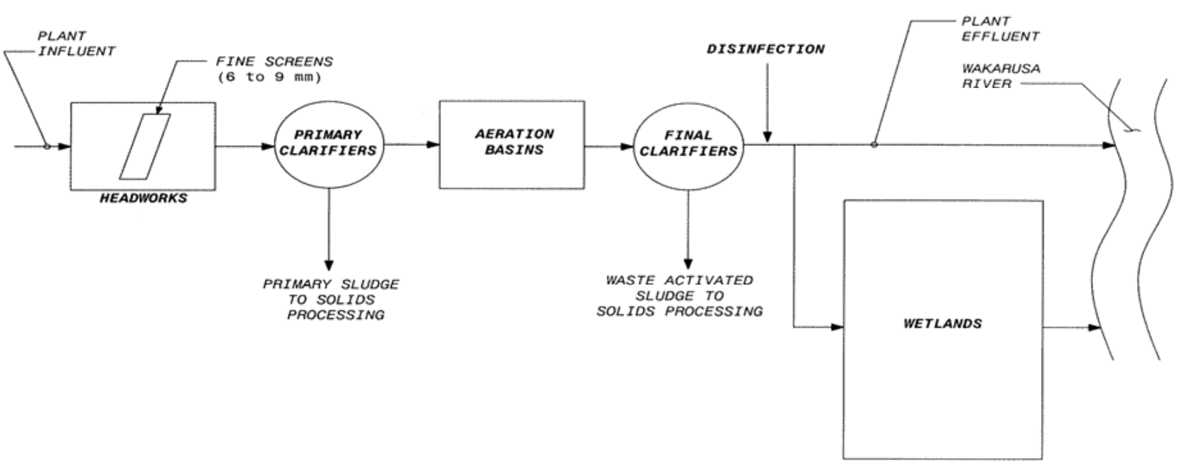
SMALL FOOTPRINT



MEDIUM FOOTPRINT



LARGE FOOTPRINT



High-level process investigations were completed to allow the estimation of a required area for a 50 mgd facility of each of the footprint sizes. Each of the area requirements includes a 1000 foot buffer on all sides for all treatment processes, excluding the wetland treatment portion of the large alternative. Additionally, each area also includes space for handling wet-weather flows as well as solids management. The calculated areas were then superimposed onto the general areas under consideration. Evaluation of each of these footprint alternatives was completed at each of the seven general sites. The footprint requirement for the each of the alternatives is given in Table 2 below.

Table 2. Acreage requirements by process footprint alternative

Footprint Alternative	Acreage required (acres)
Small	235
Medium	300
Large	1,000

Further detail on the process considerations and footprint areas are given in the January 12, 2006 memorandum given in Appendix F.

VI. Siting Factors

In order to evaluate each of the sites in relation to all of the process alternatives, a set of criteria was determined. In addition to establishing the criteria, weights of the criteria's relative importance were established for evaluation purposes. Criteria were divided into primary and sub categories. Primary criteria must be met to ensure the overall goal of the project is satisfied. Sub-criteria provide some granularity of the issues which make up the broader primary topics. The Consultants developed a preliminary set of criteria and distributed it to City Staff and the PAC members for individual comment and relative weighting of the individual criterion. City Staff and PAC comments were compiled and presented to the group during a PAC meeting. The entire group discussed the results and suggested changes, which included adding additional criteria at both the primary and secondary levels. The survey form was revised to incorporate the comments from the PAC meeting. Results from the second version of the survey were collected and compiled; the criteria, as well as their definitions, and relative weights, are presented below.

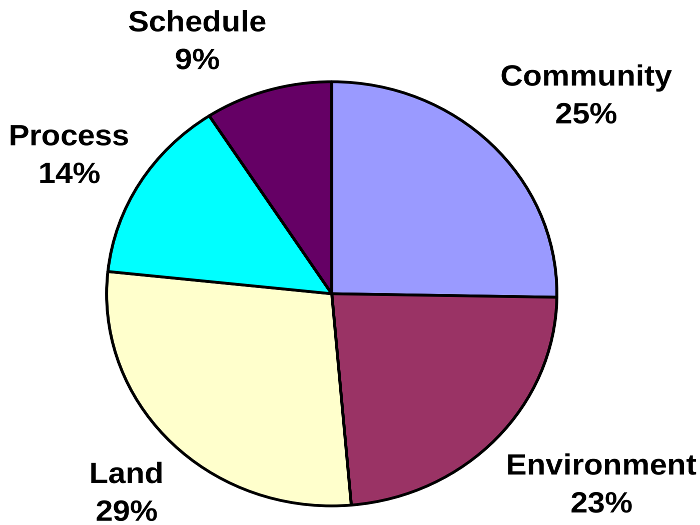
Primary Criteria

i. Community
ii. Environment
iii. Land

iv. Process
v. Schedule

The blended results of the PAC and City Staff's weightings of the primary criteria are shown in Figure 3 below.

Figure 3. Blended PAC City Staff Ranking of Primary Criteria



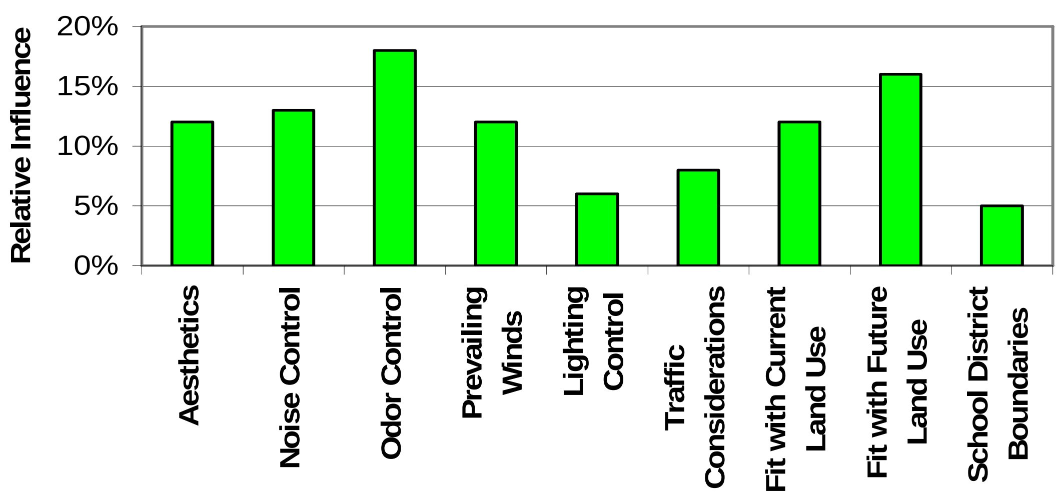
Sub-Criteria

Community

- **Aesthetics –** architectural or landscaping modifications to make site acceptable to the public
- **Noise Control –** additional technologies or buffer space to control off-site noise impacts
- **Odor Control –** technology or buffer to reduce fence-line odor impacts on a calm day
- **Prevailing Winds –** considers disposition of odors carried by winds to the northeast
- **Lighting Control –** additional technologies or buffer space to control offsite lighting impacts
- **Traffic Considerations –** length of route to highway and area traveled through
- **Fit with Current Land Use –** considers site with current property use
- **Fit with Future Land Use –** considers site with future property use from City 2025 Land Use Plan
- **School District Boundaries –** considers facility locations as it influences population growth outside of the UGA and the relationship to school district boundaries

The blended results of the PAC and City Staff's weightings of the Community Sub-criteria are shown in Figure 4 below.

Figure 4. Blended PAC City Staff Ranking of Community Sub-Criteria

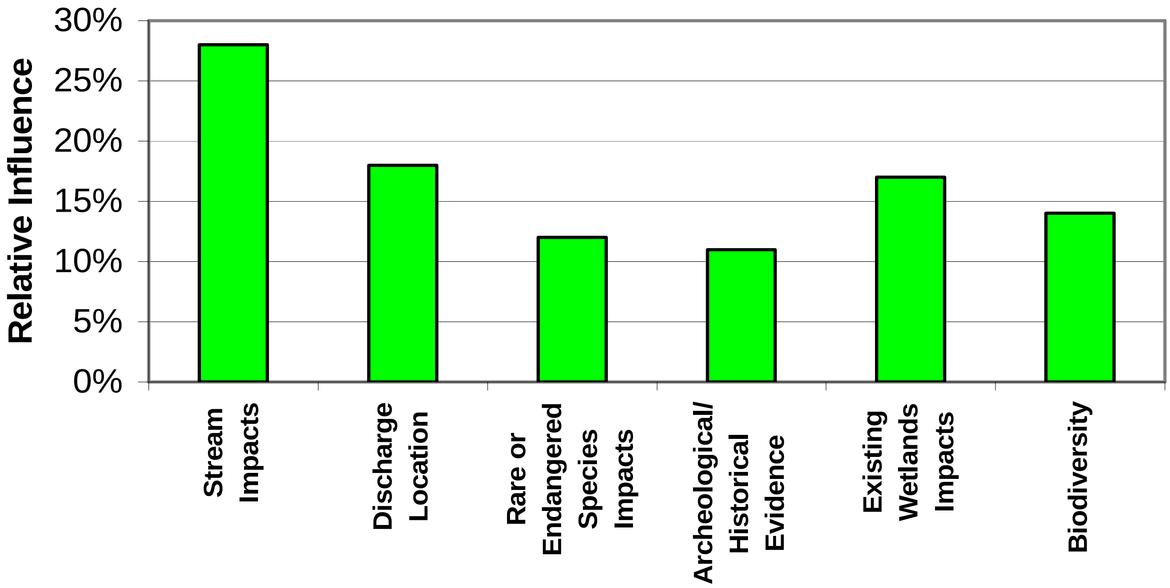


Environment

- **Stream Impacts –** considers water quality from facility, all technologies assumed to meet permit requirements
- **Discharge Location** – addresses issues regarding stream relationship between facility and the Haskell-Baker Wetlands
- **Rare or Endangered Species Impacts –** considers how site impacts rare and/or endangered species, relates to proposed facility footprint
- **Archeological/Historical Evidence** – considers previously identified archeological/historical evidence, includes consideration of local history
- **Existing Floodplain/Wetlands Impacts –** considers impacts on existing hydric soils and/or floodplain
- **Biodiversity –** considers impacts on flora and fauna of area, relates to proposed facility footprint

The blended results of the PAC and City Staff's weightings of the Environment Sub-criteria are shown in Figure 5 below.

Figure 5. Blended PAC City Staff Ranking of Environment Sub-Criteria

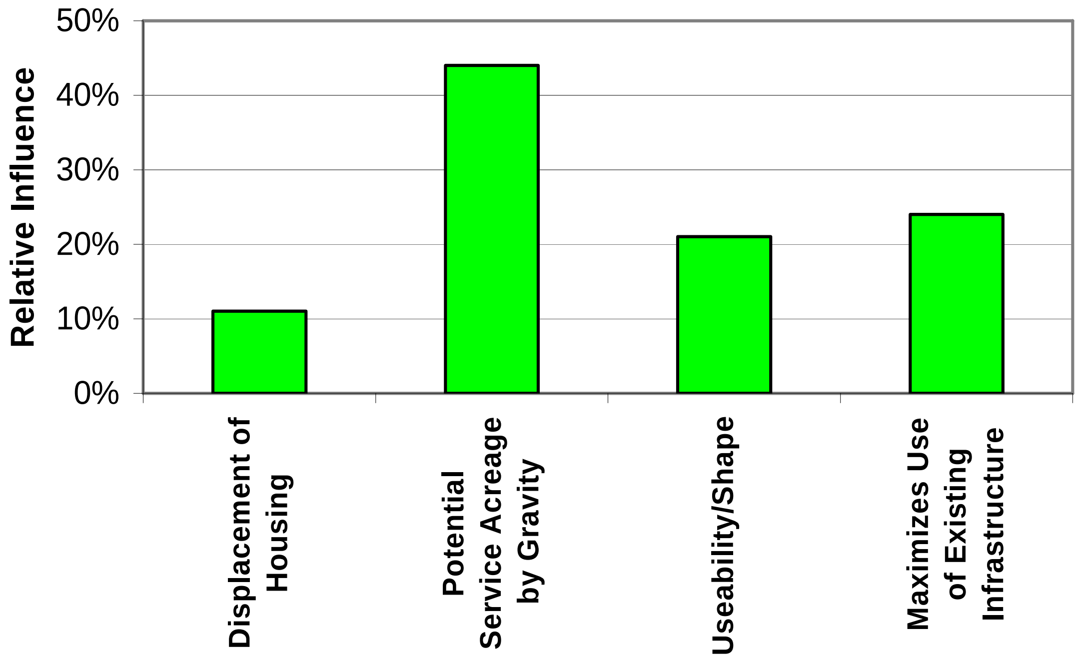


Land

- **Displacement of Housing –** number of houses that would be displaced by facility in a given area
- **Potential Service Acreage by Gravity –** increased service area by gravity will reduce future build-out costs by reducing pumping requirements for future expansion
- **Usability/Shape –** topography and shape of site related to how well the site may be utilized now and in the future, greater usability provides greater flexibility
- **Maximizes Use of Existing Infrastructure –** considers proximity to existing collections system connection as well as existing wastewater treatment plant for flexibility in solids disposal

The blended results of the PAC and City Staff's weightings of the Environment Sub-criteria are shown in Figure 6 below.

Figure 6. Blended PAC City Staff Ranking of Land Sub-Criteria

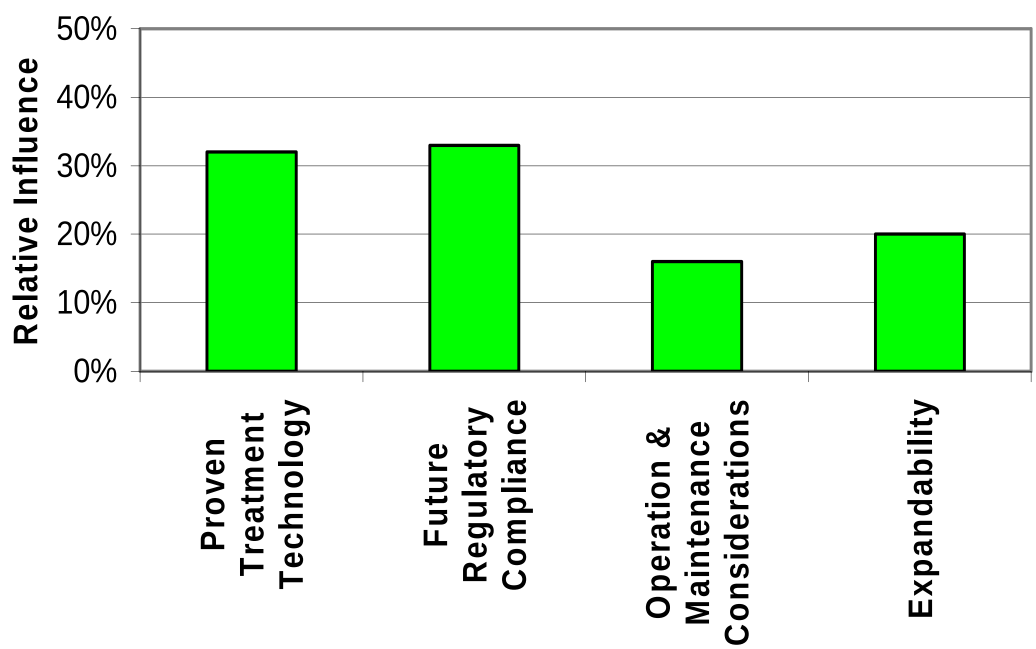


Process

- **Proven Treatment Technology –** considers national and state numbers of installations as well as consistency of performance
- **Future Regulatory Compliance –** considers ability to meet future regulatory requirements
- **Operations & Maintenance Considerations –** considers ease of operation and maintenance and staff familiarity with process
- **Expandability –** considers ease with which facility could be expanded to accommodate future growth within service area, including space requirements and flexibility in increasing facility capacity

The blended results of the PAC and City Staff's weightings of the Environment Sub-criteria are shown in Figure 7 below.

Figure 7. Blended PAC City Staff Ranking of Process Sub-Criteria

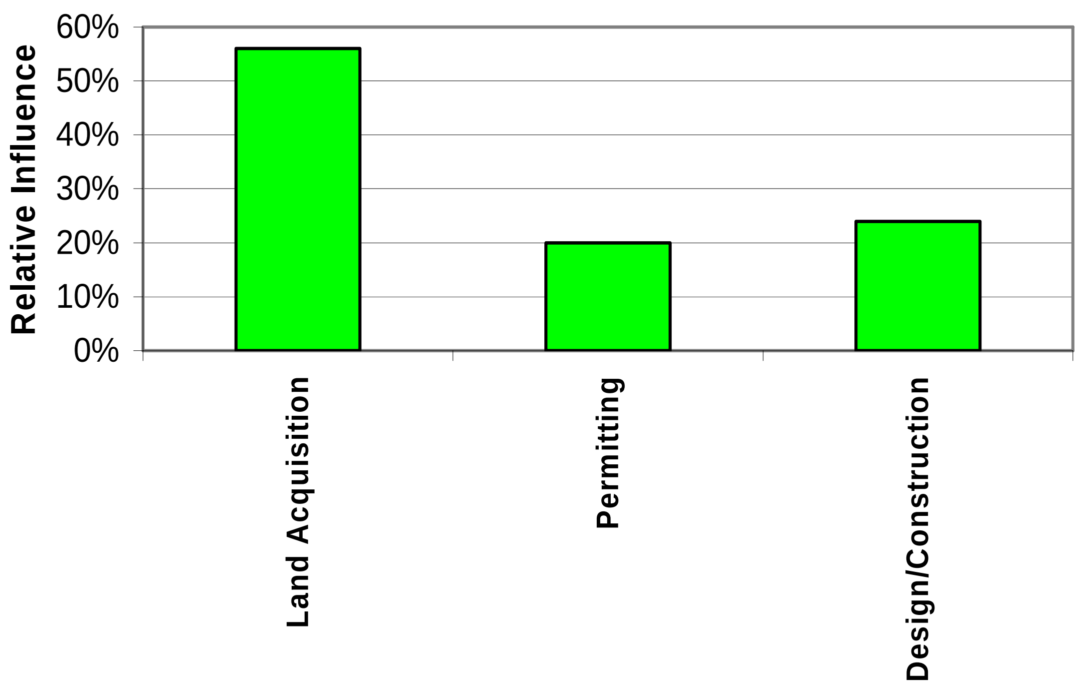


Schedule

- **Land Acquisition –** duration and ease with which necessary land to fit facility footprint may be acquired
- **Permitting –** considers duration and ease of permitting, including agency familiarity with technology, impacts on rare and endangered species, and historical resources
- **Design/Construction –** amount of time necessary for design and construction of desired process within the given area

The blended results of the PAC and City Staff's weightings of the Environment Sub-criteria are shown in Figure 8 below.

Figure 8. Blended PAC City Staff Ranking of Schedule Sub-Criteria



VII. Benefit Scores

Once the weights of the criteria had been established, the PAC/City Staff were asked to provide their input on rankings of each of the site/footprint combinations with regard to each of the selected criteria.

In advance of PAC Workshop #2, each member of the PAC and City Staff was given a packet containing the map of potential site areas by color (Figure 2) and a preliminary matrix of alternative attributes as well as a preliminary rankings scorecard. The alternative attributes matrix provided a brief summary of distinguishing factors for each of the site/footprint combinations. The scorecard matrix had been pre-populated with the preliminary rankings developed by the Consultants in conjunction with City Staff. The sub-criteria were scored from one to five, where a score of five/darkest color represents the least impact (best), while a score of one/lightest color demonstrates the highest impact (worst).

At PAC Workshop #2, the attendees were split into two groups to discuss the rankings for the sub-criteria within the "Community" and "Environment" criteria. These two criteria were chosen to receive the greatest focus as they are the most subjective categories of the sub-criteria considered. For each of the sub-criteria, the Consultants stepped the PAC members through the thought processes that led to each of the preliminary rankings. PAC members were given the opportunity to ask questions, make comments, and suggest changes to the preliminary rankings. All individuals were able to provide their comments on both the Community and Environment criteria. As part of the discussion and comment process, each PAC member was given a number of dot stickers to place on any sub-criteria rankings with which they disagreed. A scan of the comments received through this "dot exercise" as well as copies of the preliminary attributes matrix and preliminary ratings scorecards are available within the PAC Meeting #2 information, given in Appendix A.

Following Workshop #2, PAC comments on the Community and Environment categories were reviewed and the suggested changes were made. The updated rankings were reviewed with the PAC members at the beginning of PAC Workshop #3. As a whole, the PAC members appeared satisfied with the changes made to the rankings based on their comments. Following review of the Community and Environment criteria updated rankings, the rationale behind the preliminary rankings for the "Land," "Process," and "Schedule" primary categories was reviewed with the PAC.

A summary of the final scoring results may be found in Appendix G. In addition to the final score, a brief description of the reasoning behind the score is also included. A ranking of one indicates the highest impact (worst score), whereas a ranking of five indicates the lowest impact (best score).

Once the individual criteria rankings for the 21 site/footprint combinations were completed, these results were combined with the PAC/Staff criteria weightings from the scorecards to calculate a benefit score for each of the 21 options. This was accomplished using Criterium DecisionPlus (CDP) software. CDP is a software tool used to calculate a "benefit score" by mathematically combining all the rankings of each alternative with the weighted importance scores determined for each criterion. The benefit score provides a means of comparing the "value" of each of the site/footprint combinations against each other when measured against the decision criteria. This process allows the inclusion of intangible site factors that are not amenable to having a specific cost developed for them. CDP output data for the development of benefit (called decision scores in CDP documentation) scores is given in Appendix H.

VIII. Cost Evaluations

Complete high-level preliminary opinions of probable costs were completed for each of the three alternative technology footprints, at each of the sites identified by color in Figure 2, for a total of 21 cost options.

Capital costs were calculated to incorporate treatment facilities, including excess flow handling and solids management for each of the three technology footprints, as well as the purchase of land and any applicable housing. Infrastructure related costs, such as the provision of secondary power and collection system upgrades, were taken into account. Where applicable, site specific mitigations costs were also included, such as flood protection, floodplain mitigation, and highway relocation. The mitigation costs also include placeholders for any additional site-specific architectural modifications or odor control that would likely be required for public acceptance at a given site. The facility related site modifications and infrastructure costs were combined with the improvements recommended in the updated master planning that has occurred since the *2003 Wastewater Master Plan*. The total capital cost of these improvements, in February 2003 dollars, may be found in Table 3.

All cost estimates were based upon the facility areas required for a 7 mgd plant of each configuration. An acreage was established for the conventional (medium) plant option by scaling off the existing Lawrence WWTP and adding a 1000 ft buffer. Areas for the large and small facilities were estimated by scaling off the area of the 7 mgd medium facility and using the acreages for 50 mgd facility footprints as given in Table 2. Land costs for purchasing each of the sites were determined based on HNTB's property knowledge of the area and were reviewed by an appraiser for reasonableness. In addition, the number of houses on each site was estimated; each house was assessed a purchase price per house for all properties whose owners would need to be relocated as a result.

Capital costs for liquid and solids treatment was estimated on a per gallon basis for the small and medium footprint technologies. Costs for the treatment facilities were determined based upon an analysis of similar projects. Greenfield site development work is somewhat rare, especially in geographically comparable areas. The examples existing for construction of new facilities, especially in the recent post-Katrina inflated construction environment, were limited. A number of knowledgeable B&V

professionals were consulted during the development of the $6.13 per gallon cost basis for liquid treatment.   To this liquid treatment number, a solids treatment cost of $1.30 per gallon was added, based on the results of a previous solids processing economic study. Filtration costs were not incorporated; this technology would be necessary to meet future regulations. Thus, the total estimate for the solids and liquid handling portions of the conventional treatment plant was $7.43 per gallon.

The costs for the large footprint facilities were developed by taking the costs for the conventional (medium footprint) treatment plant and including the costs for the additional land and development of the wetlands. The cost to establish the wetlands utilizes the estimate developed by Dr.Kadlec, a recognized expert in wetlands treatment.

A number of greenfield small footprint technology plants were studied to determine an estimate of cost per gallon processed within a Membrane Bio Reactor (MBR, small footprint). The results of this analysis showed wide cost variation – depending on scope and location. As such, a number of B&V professionals were consulted to establish the cost of the membrane facility to be an additional $1.50 per gallon over the conventional plant. Solids treatment was also included at the same rate as discussed for the conventional facility, yielding a total estimate of $8.93 per gallon for construction of the small footprint facility.

The cost of wet weather flow treatment for all options was estimated by scaling of the escalated costs for the Ballasted Flocculation (Actiflo®) process that was built at the existing Kansas River WWTP, adding an additional $0.29 per gallon wet weather flow. Based on historical values, a peaking factor of 6 was utilized to size the wet weather treatment facility for costing purposes.

Electrical costs include a single utility feed and an engine generator. Westar was contacted regarding the ability to provide power to the identified areas. Westar confirmed there is currently no power in this region, but that the areas under consideration could be serviced. Westar was unable to offer an estimate regarding cost differentiation among sites. It is likely that it will be easier to supply power to the sites located west of Highway 59 than it will be to those east of the highway due to closer proximity to an existing substation. However, Westar did not anticipate a significant cost differential between the sites. The sites can also be serviced by other utilities, such as water and natural gas, and this is not anticipated to be a significant cost differentiator between sites.

In determining the cost differential between each of the alternative sites, it was important to establish the individual site mitigation factors that would impact the cost of placing the facility at a given location. Examples of site mitigation factors include flood protection; additional architectural, landscaping, or odor control required due to surrounding land uses; as well as any necessary relocation of roads.

It is required by KDHE's *Minimum Standards of Design for Water Pollution Control Facilities* that facilities within a flood-prone area be provided with flood protection. As several of the sites under consideration are located within the floodplain, facility construction costs should include flood protection requirements. It was determined that the future Wakarusa WRF should be protected to the same level as the existing Kansas River WWTP (nearly 500 year flood). HNTB provided an estimate of the elevation required to meet this level of protection at each of the sites.

Flood protection may be accomplished through bringing in fill to increase the level of the site to the required elevation or by building a berm around the facility. Bringing in site fill is the protection method that was utilized for the included cost estimates. The amount of fill needed to bring the site from its current average elevation to the required flood protection elevation was calculated and costed at current site fill prices. It should be noted for the cost estimates that only the actual facility site area, and not the1000 ft buffer, was provided with flood protection.

It was determined that some site alternatives, due to their locations, would require additional architectural and/or landscaping treatment. A $2M allowance was included in the cost estimates for the Purple, Red, and Orange sites due to their proximity to the western gateway to the city. It is anticipated that a facility placed at any of these sites would require more aesthetic treatment to make the facility acceptable to the public.

The Purple and Red sites are each bisected by N 1200 Road. While it is possible to shift a facility located at the Purple site south of the highway by purchasing more homes, it is not feasible to use the Red site location without relocating N 1200 Road. An estimate of $3M was added to each of the process alternatives at the Red site to allow for relocation of the roadway.

While odor control for the facility will be important at any of the locations, it has even greater significance for the sites located in close proximity to neighbors or within a particularly public location. An additional allowance for odor control technologies was included for the Red, Purple, and Orange sites due to their position at the west gateway to the City. To a lesser extent, the Yellow site was also given an allowance due to the need to put the headworks of the facility fairly close to a property line.

In addition to the site mitigation factors, sites which required flood protection within the floodplain must be mitigated to provide "no rise" for the 100 year flood water surface elevation within the floodplain. An estimate of the amount of material that must be removed from the floodplain in order to mitigate for any floodplain that was lost due to flood protection is included. It was assumed that floodplain mitigation could occur within the buffer of the site and no additional land would need to be purchased for the mitigation. The results of a detailed hydraulic analysis must be used to determine the actual locations on the site that floodplain mitigation must occur in order to comply with the City's floodplain regulations.

In addition to the actual facility and site mitigation costs, capital costs were also estimated to provide a cost differential for the improvements required to connect each of the site alternatives to the collection system. Preliminary conveyance system corridors were developed to determine the collection system improvements required for each of the site alternatives. Drawings of the preliminary conveyance corridors are given in Appendix I. Required pump station capacity, lengths of sewer, and lengths of force main were estimated for each of the site configuration. The current cost estimates for sewerage and force main costs per length were applied to each of the piping configurations for the different sites. Pump station capacities required to connect each of the sites were estimated; a cost per mgd of pump station capacity based on previous work was then applied to determine total pump stations costs.

The City of Lawrence Planning has confirmed that the development of the southeast and northwest areas represents population relocation, and not new growth. Therefore, no treatment costs from these areas have been included in the cost estimates. The additional collection systems required to service the southeast and northwest are included in the Collection System line given in Table 3.

Capital costs calculated do not account for the impacts or improvements required to off site roads (unless road is relocated as a result of plant location) or any community amenities that might be added to the facility. In addition, the capital costs do not reflect any required benefit district improvements. Only the site specific mitigation items with calculable associated costs were included in the capital cost estimates. It should be noted that other intangible factors such as ease of permitting and usability/shape of the site have not been included in the costs, but will have an impact on project schedule. These types of intangible costs have been taken into account through the benefit scores calculated for each site and footprint.

Annual operations and maintenance (O&M) costs for each type of process technology were also compiled. The O&M costs for the medium footprint conventional facility were calculated by scaling the existing Kansas River WWTP on a dollar per gallon treated basis. As no directly applicable O&M cost for the operation of a small footprint MBR plant could be determined, the O&M costs were “built-up” based on previous project experience. The O&M requirements that were deemed to be “beyond” those in a conventional facility were totaled on a cost per gallon basis, such as scour air and chemicals for membrane cleaning. The annual MBR O&M cost was then determined by adding a fraction of this differential cost to the O&M costs for the conventional plant. The purpose of the fraction is to correct for synergistic savings gained within the MBR process.

O&M cost estimates for the large footprint technology were determined by combining the O&M estimates for the operation of a conventional footprint facility with those for a wetland treatment process. Dr. Kadlec provided the wetland O&M cost per acre based on his experience. O&M costs estimates for the collection system were based on current City costs corrected to meet the capacity requirements for the new facility.

In addition to the capital cost of the Wakarusa WRF and associated improvements, Table 3 also provides a twenty-year present worth analysis representing the construction and operation of the WRF and associated facilities at each of the various site locations. The assessment is based on a 2011 start-up of the facility.

Table 3. Summary of preliminary costs for 7mgd small, medium, and large footprint options.

Wakarusa Water Reclamation Facility
Opinion of Probable Project Cost

	7 mgd Small Footprint						
	Green	Yellow	White	Blue	Purple	Red	Orange
Water Reclamation Facility							
Acquire Land/Purchase Housing- 235 Acres (for 50 mgd capacity)	$1,200,000	$1,700,000	$1,200,000	$4,700,000	$1,600,000	$2,300,000	$1,200,000
WRF (Liquids and Solids Treatment)	$62,500,000	$62,500,000	$62,500,000	$62,500,000	$62,500,000	$62,500,000	$62,500,000
Excess Flow Facilities (Ballasted Flocculation)	$12,400,000	$12,400,000	$12,400,000	$12,400,000	$12,400,000	$12,400,000	$12,400,000
Electrical Power and Engine Generator	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000
Site Mitigation							
Flood Protection and Site Fill	$400,000	$100,000	$800,000	$300,000	$300,000	$200,000	$500,000
Additional Architectural and Landscaping Treatment	$0	$0	$0	$0	$2,000,000	$2,000,000	$2,000,000
Relocate Highway	$0	$0	$0	$0	$0	$3,000,000	$0
Odor Control Systems	$0	$500,000	$0	$0	$1,000,000	$1,000,000	$1,000,000
Floodplain Mitigation	$100,000	$0	$200,000	$0	$0	$0	$100,000
WRF Subtotal	*$78,100,000*	*$78,700,000*	*$78,600,000*	*$81,400,000*	*$81,300,000*	*$84,900,000*	*$81,200,000*
Collection System	$26,500,000	$18,400,000	$17,000,000	$17,400,000	$10,000,000	$13,700,000	$22,800,000
TOTAL 7 MGD SMALL FOOTPRINT CAPITAL COST	**$104,600,000**	**$97,100,000**	**$95,600,000**	**$98,800,000**	**$91,300,000**	**$98,600,000**	**$104,000,000**
TOTAL 7 MGD SMALL FOOTPRINT 20-YEAR PRESENT WORTH	**$169,300,000**	**$159,000,000**	**$156,900,000**	**$161,200,000**	**$151,000,000**	**$160,100,000**	**$168,300,000**
	7 mgd Medium Footprint						
	Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
Water Reclamation Facility							
Acquire Land/Purchase Housing - 300 Acres (for 50 mgd capacity)	$1,500,000	$2,300,000	$3,100,000	$6,600,000	$3,500,000	$3,000,000	$2,500,000
WRF (Liquids and Solids Treatment)	$52,000,000	$53,000,000	$52,000,000	$52,000,000	$52,000,000	$53,000,000	$53,000,000
Excess Flow Facilities (Ballasted Flocculation)	$12,400,000	$12,400,000	$12,400,000	$12,400,000	$12,400,000	$12,400,000	$12,400,000
Electrical Power and Engine Generator	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000
Site Mitigation							
Flood Protection and Site Fill	$1,600,000	$100,000	$3,000,000	$1,000,000	$1,300,000	$1,000,000	$1,900,000
Additional Architectural and Landscaping Treatment	$0	$0	$0	$0	$2,000,000	$2,000,000	$2,000,000
Relocate Highway	$0	$0	$0	$0	$0	$3,000,000	$0
Odor Control Systems	$0	$1,100,000	$0	$0	$1,500,000	$1,500,000	$1,000,000
Floodplain Mitigation	$300,000	$0	$800,000	$0	$200,000	$0	$300,000
WRF Subtotal	*$69,300,000*	*$70,400,000*	*$72,800,000*	*$73,500,000*	*$74,400,000*	*$77,400,000*	*$74,600,000*
Collection System	$26,500,000	$18,400,000	$17,000,000	$17,400,000	$10,000,000	$13,700,000	$22,800,000
TOTAL 7 MGD MEDIUM FOOTPRINT CAPITAL COSTS	**$95,800,000**	**$88,800,000**	**$89,800,000**	**$90,900,000**	**$84,400,000**	**$91,100,000**	**$97,400,000**
TOTAL 7 MGD MEDIUM FOOTPRINT 20-YEAR PRESENT WORTH	**$140,300,000**	**$132,300,000**	**$126,800,000**	**$134,500,000**	**$125,800,000**	**$133,500,000**	**$141,700,000**
	7 mgd Large Footprint						
	Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
Water Reclamation Facility							
Acquire Land/Purchase Housing - 1,000 Acres (for 50 mgd capacity)	$6,500,000	$9,500,000	$18,700,000	$24,200,000	$27,900,000	$10,700,000	$16,500,000
WRF (Liquids and Solids Treatment)	$52,000,000	$53,000,000	$52,000,000	$52,000,000	$52,000,000	$53,000,000	$53,000,000
Excess Flow Facilities (Ballasted Flocculation)	$12,400,000	$12,400,000	$12,400,000	$12,400,000	$12,400,000	$12,400,000	$12,400,000
Electrical Power and Engine Generator	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000	$1,500,000
Site Mitigation							
Flood Protection and Site Fill	$1,600,000	$100,000	$3,000,000	$1,000,000	$1,300,000	$1,000,000	$1,900,000
Additional Architectural and Landscaping Treatment	$0	$0	$0	$0	$2,000,000	$2,000,000	$2,000,000
Relocate Highway	$0	$0	$0	$0	$0	$3,000,000	$0
Odor Control Systems	$0	$1,100,000	$0	$0	$1,500,000	$1,500,000	$1,000,000
Cost for Wetlands Treatment - 450 acres	$8,600,000	$8,600,000	$8,600,000	$8,600,000	$8,600,000	$8,600,000	$8,600,000
Floodplain Mitigation	$10,500,000	$0	$5,900,000	$0	$1,300,000	$0	$2,500,000
WRF Subtotal	*$93,100,000*	*$86,200,000*	*$102,100,000*	*$99,700,000*	*$108,500,000*	*$93,700,000*	*$99,400,000*
Collection System	$26,500,000	$18,400,000	$17,000,000	$17,400,000	$10,000,000	$13,700,000	$22,800,000
TOTAL 7 MGD LARGE FOOTPRINT LARGE CAPITAL COSTS	**$119,600,000**	**$104,600,000**	**$119,100,000**	**$117,100,000**	**$118,500,000**	**$107,400,000**	**$122,200,000**
TOTAL 7 MGD LARGE FOOTPRINT 20-YEAR PRESENT WORTH	**$169,000,000**	**$152,300,000**	**$166,500,000**	**$165,700,000**	**$162,700,000**	**$154,000,000**	**$171,400,000**

IX. Site Comparison

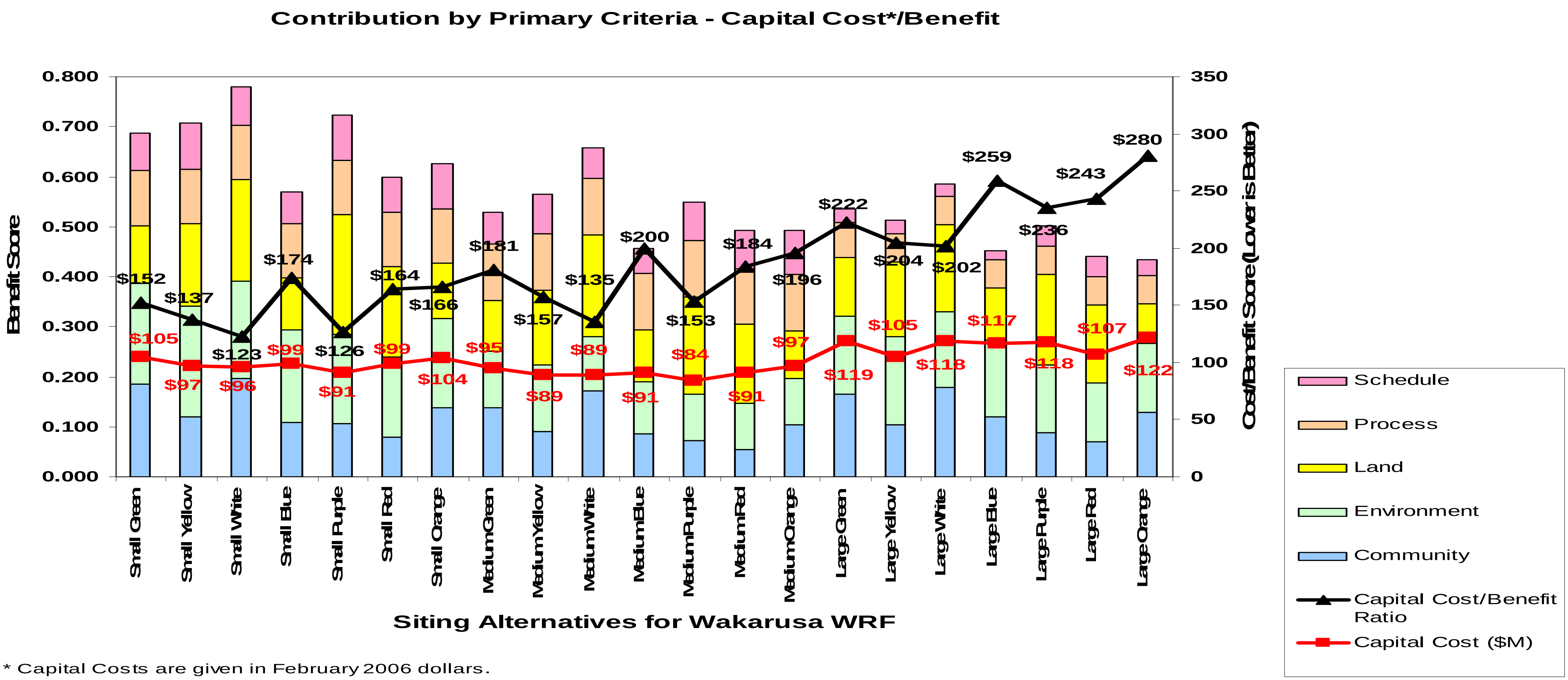
For each site and process footprint combination, a benefit/cost ratio was calculated. This cost/benefit score incorporates both project costs as well as PAC/Staff-assigned benefit scores discussed in Section VII above. A lower cost/benefit score indicates a better alternative, meaning that alternative provides a higher value per unit cost.

Figure 9 on the following page provides data regarding the capital cost of construction of the Wakarusa WRF and associated facilities (as summarized in Table 3) as well as the benefit scores for each of the options. Based on the cost/benefit score, small white and small purple, followed by medium white, emerge as the best alternatives. All other alternatives' cost benefit ratios are more than 10% greater than small white, the alternative with the lowest cost-benefit ratio. Alternatives with capital costs within 10% should be considered similar from a cost standpoint at this level of detail.

Figure 9 does not give a complete picture of the construction and operation costs of the facilities over the life of the project Figure 10 provides the 20-year present worth of the facilities, considering the associated O&M costs. The graph of the cost/benefit ratio based on the 20-year present worth provides the most comprehensive picture of the overall costs of building and operating the facility over the life of the project, while also considering the facility location and footprint that provides the most value as determined by the PAC/Staff criteria evaluations.

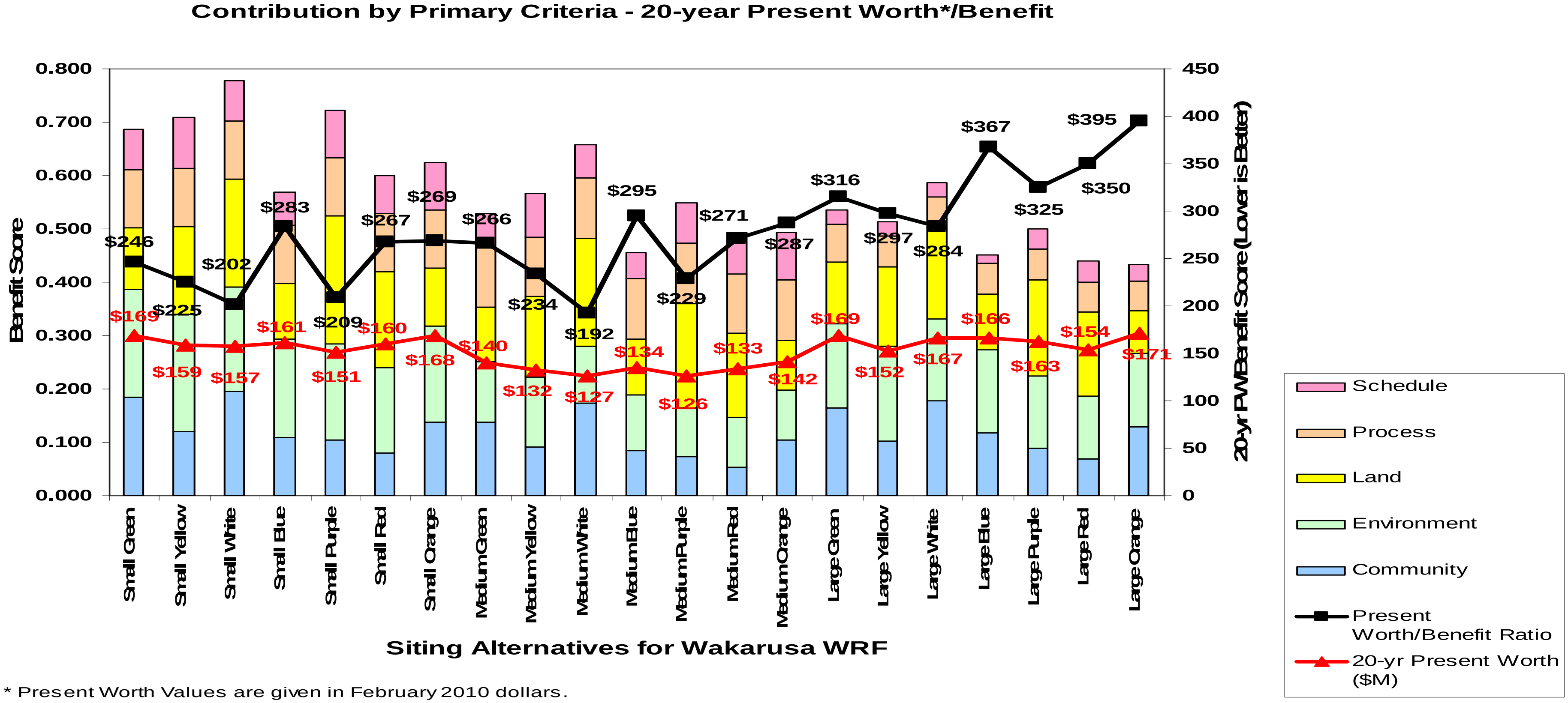
Based on the information provided in Figure 10, it can be seen that the medium footprint technology applied on the white site offers the highest value at the lowest cost, followed by the small technology applied on the white, and then purple, sites. Due to its greater flexibility, the white site is recommended as the highest rated alternative, followed by the purple site. It is recommended that the City plan to purchase a minimum of 300 acres to accommodate either a small or medium footprint facility.

Figure 9



* Capital Costs are given in February 2006 dollars.

Figure 10



* Present Worth Values are given in February 2010 dollars.

X. Site Amenities

In addition to treatment facilities, the community may decide it wants the Wakarusa WRF to provide additional features for the public's use. Depending on the desired feature, these amenities may be added to the project and incorporated into the buffer space as allowable. Based on public response via stakeholder interviews as well as public meeting surveys, suggested amenities include:

- Walking/biking trails
- Additional green space or park land
- Wetlands
- Contained wetlands
- Microbial fuel cells
- Microturbines
- Reuse methane
- Heat pump for plant effluent

Additional Commission input will be provided on the scope and extent of any type of amenity to be incorporated within the site. Clearly, the opportunity for the addition of amenities is possible with any process footprint or facility location. Site amenities will be further investigated during development of the Basis of Design Report. A summary of the amenities investigated thus far is given in Appendix J.

XI. Selection of Two Sites for Further Investigation

The City of Lawrence desires to follow a parallel path of further investigation of two sites, each a minimum of 300 acres. This strategy will provide for some competition within the marketplace and offer an alternative option should a "fatal flaw" be identified at a site or a permitting issue arise at one of the locations. Based on the cost/benefit analysis of the sites, the white and purple sites emerge as the sites that provide the highest value per unit cost and should be selected for further investigation.

Once the sites for further investigation were established, topographical and property tract maps were utilized to determine a potential location for the facility on each site. The white and purple site boundaries were located to meet land constraints as well as consider property owners' desires to sell complete or partial parcels. As a result of this analysis, the purple site consists of less than 350 acres, while the white site occupies closer to 400 acres. Some affected property owners are interested in selling additional nearby parcels. The City may have the option to purchase this land as additional buffer. Appendix K contains drawings of the preliminary layout on each of the two sites. It should be noted that the layout drawing for the white site includes the possibility that the South Lawrence Trafficway (SLT) is located along the proposed 42nd Street Alignment. The relationship of the facility footprint and the potential SLT alignment are discussed in more detail in section XIX below.

A series of desk-top studies was conducted to determine if there were any significant issues that would highlight a problem with the further investigation of either the white or the purple sites. The following desktop studies were completed with no significant findings:

- Hydraulic analysis
- Wetlands investigation
- Archeological/historic investigation
- Threatened and endangered species investigation

As no concerns were raised by the desk-top studies, on-site investigations for the white and purple sites were initiated. The City Commission authorized property owner notification to initiate a series of onsite investigations on both the white and purple sites. Dan Watkins, Esq., was contracted by the City to lead the property discussions. He was assisted by Tim Orrick and Jason Prier with Foth and Orrick.

The following investigations were completed at each site:

- Boundary surveys
- Wetlands delineation
- Archeological/historic investigation
- Threatened and endangered species investigation
- Phase I environmental assessment
- Geotechnical borings*
- Appraisal

**Geotechnical borings affect only those properties located within the area of actual facility placement, not buffer area*

The following sections of this report will summarize the main findings from the major site investigations completed on the white and purple sites. The detailed reports prepared for each of the completed site investigations are given in the companion binder to this report, *Wakarusa Water Reclamation Facility Site Investigation Reports.*

XII. Results of Hydraulic Analysis

HNTB performed a hydraulic analysis to quantify the impacts on the surrounding area's Base Flood Elevation (BFE) for the proposed 50 mgd Wakarusa WRF located at either the white or purple site.

A. White Site

The results for the white site showed that the BFE would rise by nearly 2.5 feet when full build-out of the surrounding area and maximum discharge flow of the plant are combined. While a specific study was not conducted to calculate the exact contribution of full development to this 2.5 foot rise, it should be noted that a previous study indicated that maximum flow from a 50 mgd facility would not have a significant impact (less than 0.5 feet) on the BFE. Therefore, it can be inferred that a majority of the 2.5 foot rise in BFE is due to full development of the surrounding area and not to the maximum discharge flow released by the Wakarusa WRF. Increase in flow due to future build-out conditions is related to projected offsite development and not a specific result of this project.

B. Purple Site

Similar to the results for the white site, the results for the purple showed that the BFE would rise by nearly 2.5 feet when full build-out of the surrounding area and maximum discharge flow of the plant are combined. While a specific study was not conducted to calculate the exact contribution of full development to this 2.5 foot rise, it should be noted that a previous study indicated that maximum flow from a 50 mgd facility would not have a significant impact (less than 0.5 feet) on the BFE. Therefore, it can be inferred that a majority of the 2.5 foot rise in BFE is due to full development of the surrounding area and not to the maximum discharge flow released by the Wakarusa WRF. Increase in flow due to future build-out conditions is related to projected offsite development and not a specific result of this project.

It should be noted that the rise in BFE for the white and purple sites given above assumes that any floodplain cross-sectional area reduction caused by the plant structure/fill is mitigated through restoration of equivalent floodplain cross-sectional area at some location on the acquired property. This mitigation step has been included in the costs presented in this report.

Based on the preliminary studies discussed above, it does not appear that the location of the facility at either the white or the purple sites is a significant differentiator in the hydraulic impact of the project upon the BFE of the surrounding area. The hydraulic memos prepared by HNTB are included Appendix L of this report. Additional detailed hydraulic analysis will be conducted during the Basis of Design Report phase to further quantify impacts to the Wakarusa River.

XIII. Boundary Surveys

The results of the boundary surveys performed by Bartlett & West for the white and purple sites are given in Appendix M.

XIV. Wetlands Delineations

Two environmental specialists from HNTB Corporation walked the sites to conduct a wetlands delineation focusing on creek and low areas as well as any ponds. They took plant and soil samples and looked for high water marks. The purpose of this study is to determine any areas that are under regulation by the Corps of Engineers as jurisdictional waters of the U.S. Should wetland areas be impacted, mitigation is often required at ratios of 1:1 to between 3 and 5:1. The Corps of Engineers makes the final determination on the jurisdictional designation of any ditches located on the property and the required mitigation ratios.

A. White Site

The field investigations determined that nine streams and three wetlands existing on the white site are considered jurisdictional waters of the U.S. The stream findings were anticipated based on area mapping. The three jurisdictional wetlands did not appear during the map survey and were determined during the onsite investigation. Of these three wetland areas, only one has the potential to be within the "facility" area of the white site. The originally proposed facility layout will be shifted as necessary to avoid this discovered wetland area. All other identified jurisdictional wetlands either lie within the 1000 foot buffer around the ultimate facility location or outside of the buffer, but within the boundaries of the land to be purchased. Six ditches were also identified during the study, two of which would likely be within the facility construction area.

B. Purple Site

The field investigations determined that three streams and four vegetated wetland areas existing on the purple site are considered jurisdictional waters of the U.S. The stream findings were anticipated based on area mapping. Mapping resources indicated seven wetlands within the boundary of the purple site. However, on-site investigation determined that only four of these areas would be considered "vegetated wetlands." Of these four wetlands areas, none are currently planned to lie within the area upon which the facility is to be constructed, but, instead, lie within the buffer area of the site. Likewise, none of the stream locations lie within the planned facility footprint. Two ditches were also identified during the study, one of which runs along the eastern boundary of the proposed facility footprint. The other ditch identified is located within the buffer portion of the facility siting plan.

XV. Archeological/Historic Investigation

A team of archeologists and technicians observed soil diggings and identified standing buildings on the sites. Areas surrounding any building locations were also examined in order to identify any historic properties (more than 50 years of age) that may lie within the project boundary or the project view shed. Property Owners were interviewed to collect information on historic aspects of the site.

A. White Site

The white site contains three previously identified archeological sites. However, the record shows prior study determined no additional investigation is needed at these site locations and they are not eligible for the National Register of Historic Places (NRHP). The field survey of the site located four previously unidentified sites within the project boundary as well as two isolated finds. None of the sites or isolated finds discovered during the field survey is considered eligible for the NRHP.

No previously recorded architectural properties are located within the white site boundary. During the field study, two previously unrecorded WPA-era concrete culvert structures were evaluated. Neither structure was deemed eligible for the NRHP by the investigators.

B. Purple Site

No previously identified archeological sites are located within the boundary of the purple site. The field survey of the site located two previously unidentified sites within the project boundary as well as three isolated finds. None of the sites or isolated finds discovered during the field survey is considered eligible for the NRHP.

No previously recorded architectural properties are located within the white site boundary. During the field study three previously unrecorded resources were evaluated. The investigators deemed none of these structures to be eligible for the NRHP.

XVI. Phase I Environmental Assessment

A Phase I Environmental Assessment investigation was conducted in an effort to determine if there is a potential of environmental contamination on the property. This investigation combined a desktop study of existing database records to review historic and current uses of the property with a site walk-through and the completion of a survey by the property owners.

A. White Site

The Phase I investigation revealed no evidence of a recognized, or known, environmental condition. Three potential sites were identified due to the presence of dumped debris. It is not anticipated that any of these areas have caused a significant impact. Further investigation is not deemed necessary at this time. If the City decides to purchase the properties within the white site, it may want to consider negotiating debris removal with the property owners.

B. Purple Site

The Phase I investigation revealed no evidence of a recognized, or known, environmental condition. Two potential sites were identified due to the presence of dumped debris or abandoned structures/vehicles. It is not anticipated that any of these areas have caused a significant impact. Further investigation is not deemed necessary at this time. If the City decides to purchase the properties within the purple site, it may want to consider negotiating debris removal with the property owners.

XVII. Geotechnical Investigations

Terracon drilled nine borings on each site. The borings were drilled in the 60-acre area where the proposed treatment facility would be located. The purpose of the borings is to determine the location of rock and building conditions that could impact the construction of below grade structures. Of the nine borings on each site, one boring was drilled to 60 feet while the other eight were drilled to 40 feet.

The draft geotechnical report from Terracon indicates that the subsurface and soil conditions found at the white and purple sites are similar. Therefore, based on the investigative borings completed at this time, it appears that geotechnical issues related to foundations will not be a significant differentiator in cost or ease of building between the white and purple sites

At each of the white and purple sites, bedrock strata were encountered at fairly similar elevations. As indicated by boring B-5W on the white site, surface elevation is approximately 814 with bedrock encountered roughly 52 feet below at elevation 762. Boring B-5P on the purple site indicates surface elevation at 826 with bedrock encountered roughly 58 feet below at an elevation of 768.

The upper approximately 15 feet of each site is composed of highly plastic fat clay. At depths of 20 to 30 feet the plasticity decreases to be classified as lean to fat clay and lean clay. The 40-foot borings terminated in native alluvial clay soils.

XVIII. Appraisals

An appraiser viewed each of the sites as well as studied public records concerning the property and comparable properties. An appraisal report on the value of each of the properties was prepared and provided to the City for their use in determining the market values of the properties. The appraisals determined that nominally 500 acres could be purchased on the white location for less than the purchase of slightly over 300 acres at the purple location.

XIX. Potential 42nd Street Alignment of South Lawrence Trafficway

The white site was also investigated for the possibility that the SLT could be located along the proposed 42nd Street Alignment, cutting across the southeast corner of the white site. Adjusting the previously determined scores for the criteria impacted by the possible location of the SLT on the property causes the benefit score for the white site to drop two-tenths of a point. This is not a significant change and puts the White-2 Site (white site with revised layout to accommodate SLT) directly behind the former white site alternative in the ranking hierarchy, leaving the overall order of alternatives unchanged.

The table below shows the criteria rankings which changed as a result of consideration of the SLT alignment.

Criteria	White	White-2	Comments
Aesthetics	4	3	The SLT is a bypass around the City and does not have the same gateway issues as Hwy 458. However, the SLT located at the 42nd Alignment will still bring traffic closer to the WRF than previously considered, potentially requiring greater aesthetic compensation.
Traffic Considerations	2	4	Without consideration of the SLT, the White Site is fairly isolated from a transportation standpoint. The location of the SLT near the WRF would actually improve transportation logistics, so this criteria ranking was increased.
Usability/Shape	5	3	Clearly, the presence of the SLT would reduce some of the layout flexibility of the White Site, but not to the same degree that the Purple Site is impacted by Hwy 458.

The reason the potential SLT alignment does not have a significant impact upon the benefit score of the white site is because it does not alter the categories which had the most significant weight contributions to the decision, such as stream impacts, odor control, and fit with land use.

Therefore, it was determined that the proposed site was flexible and neutral to the possibility that a portion of the SLT could be located on the site. A preliminary facility footprint drawing of the facility in relation to the potential SLT alignment is given in Appendix K.

XX. Conclusions

Based on the information summarized in this report, it is our recommendation that a medium footprint facility be constructed on the white site. As discussed in Section IX of this report, the medium footprint on the white tract offers the highest value for the lowest cost. The high rating demonstrates the recommended facility footprint and location combination to be an optimal choice, balancing facility costs with the consideration of the "intangible" characteristics which received high priority from the public.

"Intangibles," or public-perception and acceptance related characteristics, are extremely important aspects of the siting process. A significant reason for the determination of the white site as the optimal facility location is due to its isolation from highly public areas. The site is not currently bisected by well-traveled roadways. If the SLT is located on the site along the 42nd Street Alignment, this roadway would be a bypass of the city and not considered a "gateway" to the community of Lawrence as Highway 458 is on the purple site. Nestled within the floodplain of the Wakarusa River, the white site is bordered on the north and east by floodway, a natural barrier from current public areas as well as future development. The location of a reclamation facility within the white site would also provide a good fit with current land use and future land use projections of vacant/farming. In addition, fewer neighbors are currently located in close-proximity to the potential facility than in other areas considered. With its location to the southeast of central Lawrence, the white site minimizes the potential that odors carried to the northeast by prevailing winds would impact portions of Lawrence with significant population densities. It is also anticipated that a facility located in this area would receive more positive public acceptance due to the location of the facilities' effluent discharge downstream of the Haskell-Baker Wetlands.

Various physical characteristics of the white site also point to its use as the optimal site location. The site's topography and shape provide a high level of flexibility with regard to facility layout. The site is highly flexible and is neutral to the potential location of the SLT along the 42nd Street Alignment which runs across the southeast corner of the site. The white site has no residences that would need to be relocated within the site boundary, reducing the number of persons displaced from their homes as well as the costs associated with acquiring dwellings in comparison to other sites. The white site is also well-positioned between critical facilities, such as Four Seasons Pump Station and the existing Kansas River Wastewater Treatment Plant. In addition, the various research and field surveys show no "fatal flaws" with regard to aspects of the site which could impact the ability to permit the facility at the white location. Permit delays would likely add significant expense and schedule delay to the project.

The medium footprint is chosen as the lead process footprint alternative due to its higher value per unit cost as determined by the cost benefit analysis discussed in Section IX. When the cost of construction is combined with the O&M costs of the facility on a 20-year present worth basis, the medium footprint emerges as the lowest cost alternative

Aside from the increased cost in land acquisition discussed in section XVIII above, the purple site is not the optimal location due to several physical site characteristics. The site is bisected by Highway 458; in order to fit the facility on the site, a higher cost, small footprint facility would likely be required to address public acceptability of this facility at the southern gateway to the City. In addition, the purple site has two residences that would require relocation as well as several near-neighbors that may be impacted. The topography to the south and east also rises with established residences on the hills that would overlook the proposed facilities which would have negative public implications. These impediments reduce the flexibility and usability of the purple site, leading to less optimal design possibilities, higher project costs, as well as potential schedule implications.

XXI. Recommendation

The present worth analysis does not indicate the medium footprint facility constructed on the white facility to be the absolute lowest cost alternative. However, when the public-driven intangible site characteristics, as described above, are added into the mix, the medium footprint facility on the white site offers the greatest overall value for the cost. For this reason, a medium footprint facility on the white site is recommended as the optimal alternative for the new Wakarusa Water Reclamation Facility.

Agenda
Public Advisory Committee (PAC) Introductory Meeting
Wakarusa Water Reclamation Facility

Date: October 26, 2005
Time: 4:00 p.m. to 5:30 p.m.
Location: Commission Chambers

(City) Introductions & Today's Agenda — **10 minutes**

(PBA) PAC Roles & Responsibilities — **10 minutes**
- Provide your input as interested public stakeholders
- Represent your group's interests
- Conduit for public input
- Provide balance of wants/needs
- Respect others input
- Respect the confidentiality of the process

(B&V) Wastewater 101 — **15 minutes**
- Review role of the collection system
- General wastewater treatment review
- Wastewater treatment plant vs. water reclamation facility
- Typical concerns
  - Odor
  - Aesthetics
  - Noise
  - Plant and site lighting
  - Truck traffic and disposal of residuals
  - Property value impacts
  - Others?

(B&V/PBA) Project Overview — **20 minutes**
- Need for Wakarusa Water Reclamation Facility **(B&V)**
  - Horizon 2020/Land use plan
  - Master Plan Recommendations
  - Growth Rate is Exceeding Population Projections
  - Timeline
- Requirements and considerations **(B&V/HNTB)**
  - No preconceived locations
  - Accommodate gravity flow to the extent possible
  - Study area considerations
    - Existing collection system
    - Wetlands
    - Cultural & historic locations
  - Engineering issues **(B&V/HNTB/B&W)**
    - Cannot build in floodway
    - Floodplain considerations

Agenda
Public Advisory Committee (PAC) Introductory Meeting
Wakarusa Water Reclamation Facility

Date: October 26, 2005
Time: 4:00 p.m. to 5:30 p.m.
Location: Commission Chambers

- Environmental permitting
- Site geology
- Site topography
- Proximity to utilities
- Proximity to roadways
- Affordable within rate plan

<u>(B&V/PBA) Introduction to Process</u> **15 minutes**

- Public input into criteria for selection **(B&V/PBA)**
  - Public acceptability factors
  - Site utilization/Compatibility with land use
  - Appearance
- Public Advisory Committee (PAC) **(PBA)**
  - Engaged with project team throughout the process
  - May be requested to stay with team through 2011
- Stakeholder Interviews
  - Currently being scheduled/conducted
- Peer Group Roles **(B&V)**
  - Peer group qualifications
- Process overview **(B&V)**
- Expectations **(PBA)**
- Planned Meetings **(PBA)**

<u>(PBA) Group Feedback</u> **20 minutes**

- Open discussion of process and improvement potential

Wakarusa Water Reclamation Facility
PAC Members Introductory Meeting

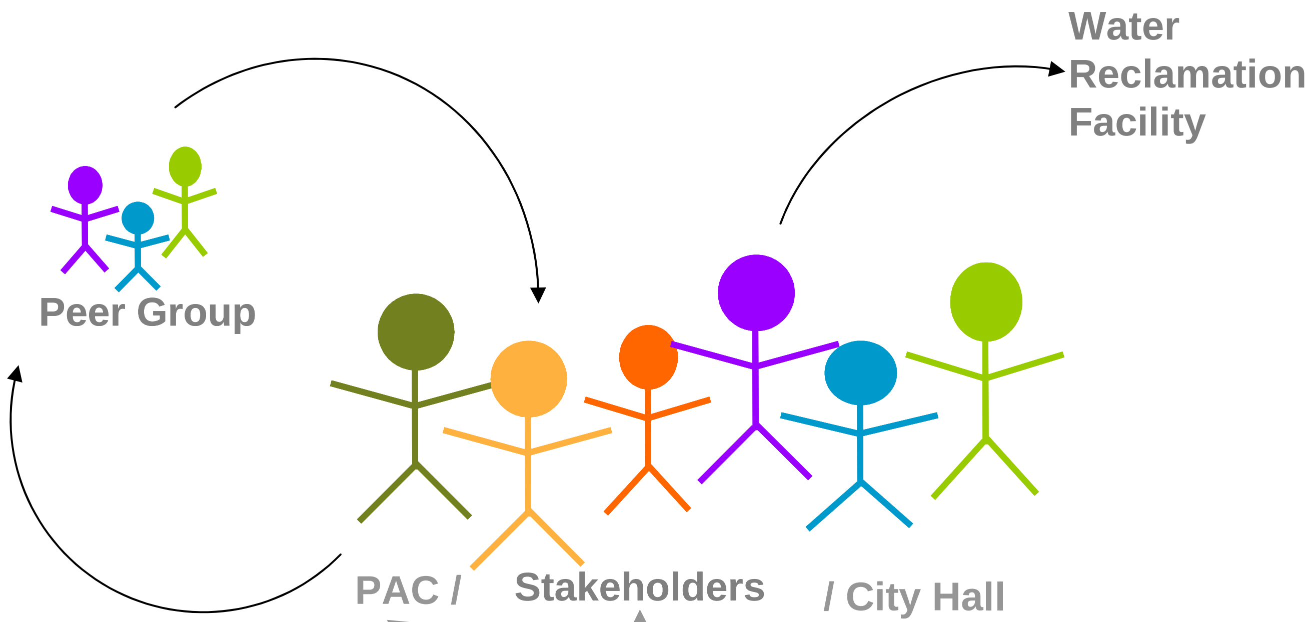
October 26, 2005
4:00 to 5:30 pm

Lawrence City Hall
Commission Chambers

Agenda

- Welcome
- Introductions
- PAC Roles and Responsibilities
- Wastewater 101
- Project Overview
- Introduction to Process
- Group Feedback

Introduction of Wakarusa Water Reclamation Facility Project Team



Community

Patti Banks Associates

Environment

HNTB
Dr. Robert Kadlec
Dr. Roger Boyd

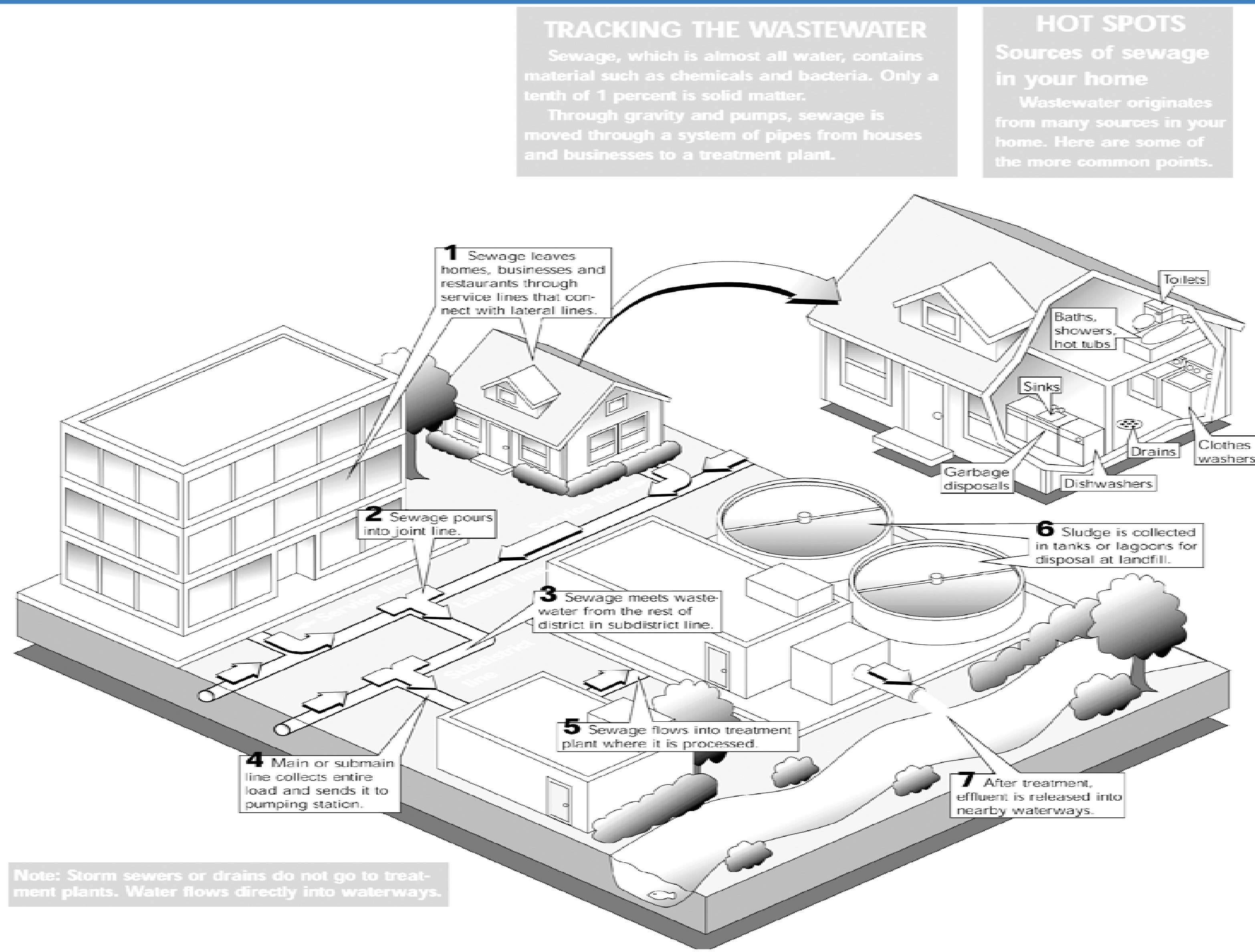
Technology

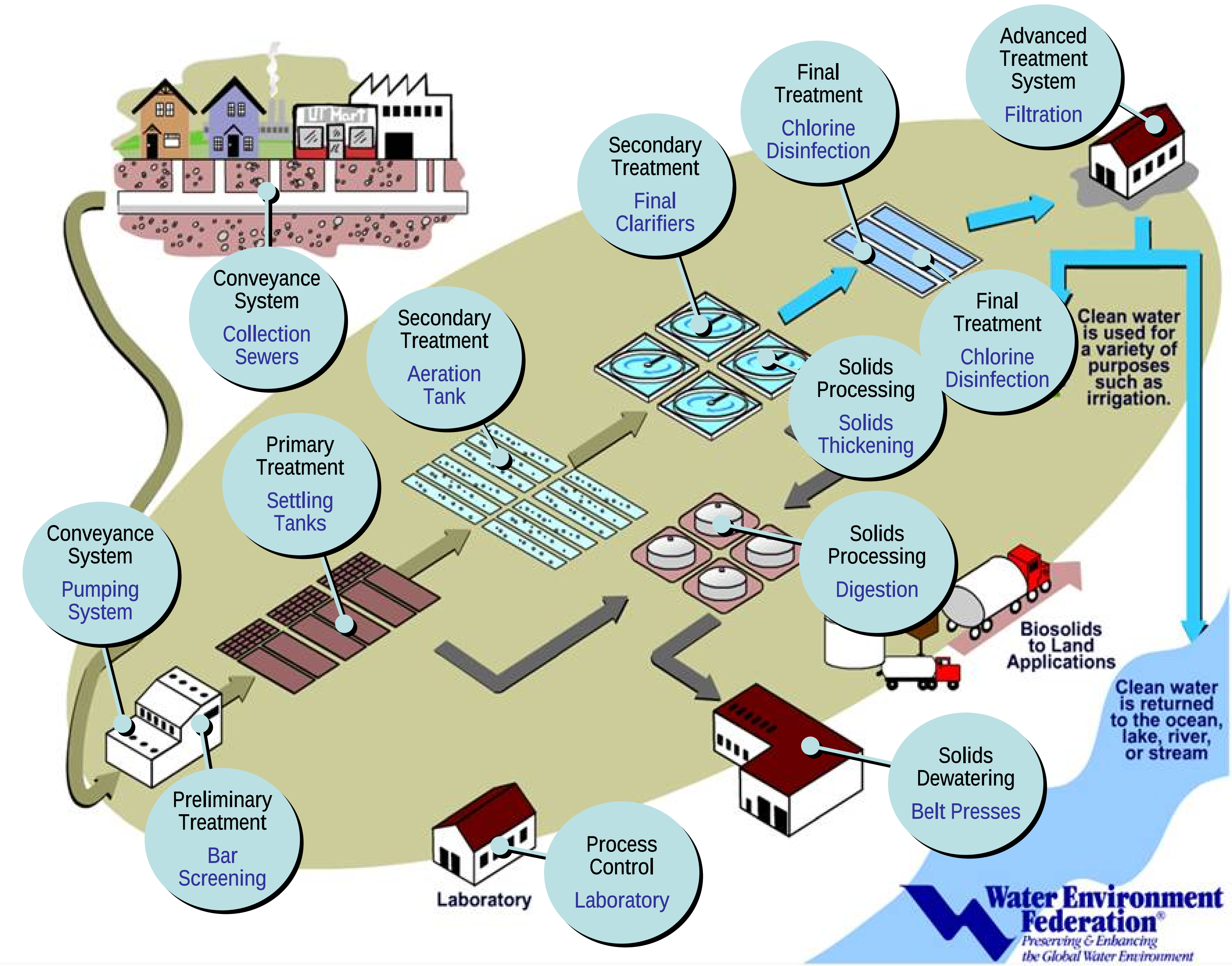
Black & Veatch
Bartlett & West

Public Advisory Committee (PAC)
Roles and Responsibilities

- Provide your input as interested public stakeholders
- Represent your group's interests
- Conduit for public input
- Provide balance of wants/needs
- Respect others input
- Respect the confidentiality of the process

Wastewater Collection and Treatment Process Overview

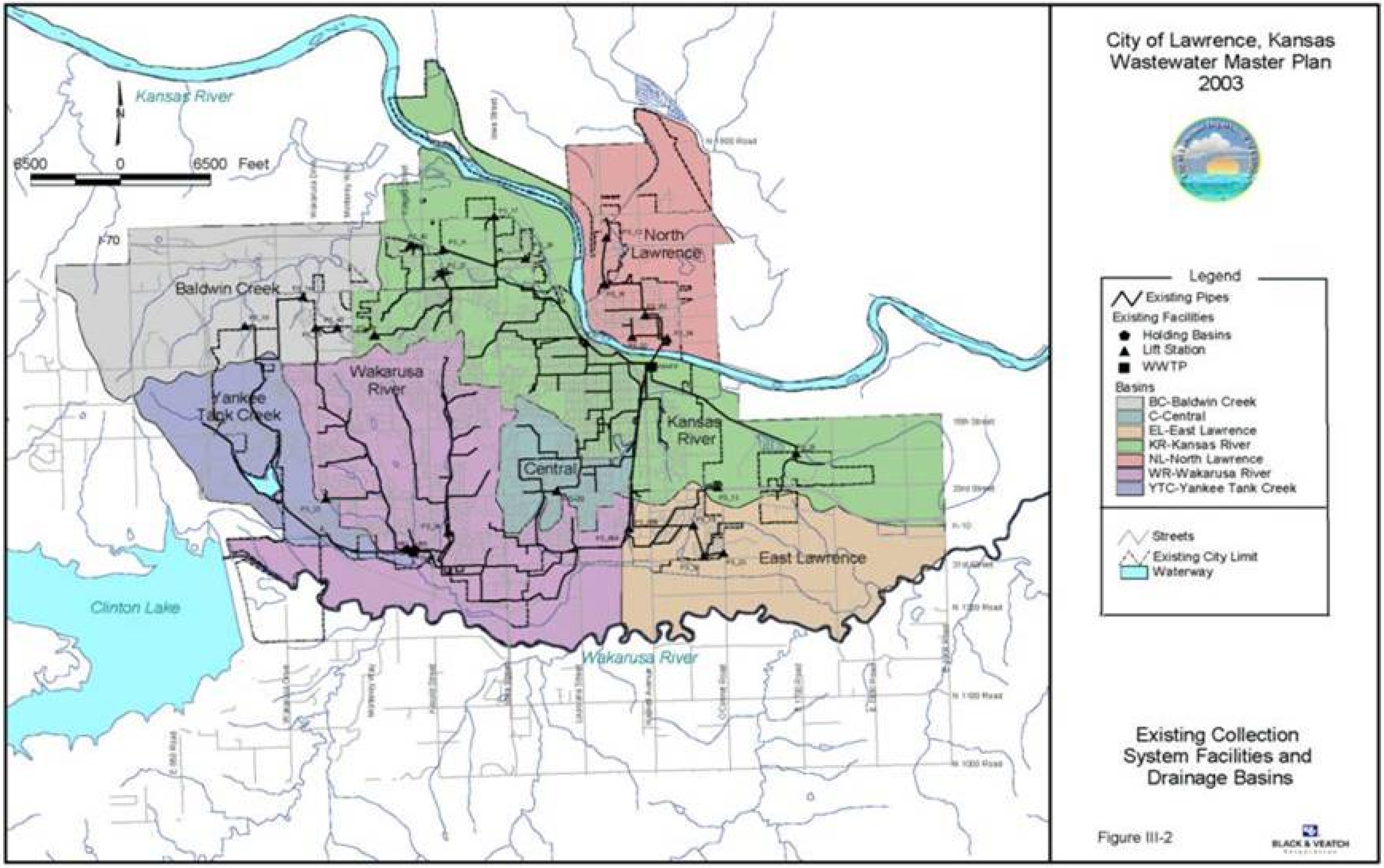



Advanced Treatment System
Filtration
Final Treatment
Chlorine Disinfection
Secondary Treatment
Final Clarifiers
Conveyance System
Collection Sewers
Secondary Treatment
Aeration Tank
Final Treatment
Chlorine Disinfection
Clean water is used for a variety of purposes such as irrigation.
Solids Processing
Solids Thickening
Primary Treatment
Settling Tanks
Conveyance System
Pumping System
Solids Processing
Digestion
Biosolids to Land Applications
Clean water is returned to the ocean, lake, river, or stream
Preliminary Treatment
Bar Screening
Solids Dewatering
Belt Presses
Laboratory
Process Control
Laboratory
Water Environment Federation®
Preserving & Enhancing the Global Water Environment

What is the difference between a wastewater treatment plant and a water reclamation facility?

- Wastewater Treatment Plant
  – treats collected wastewater
- Water Reclamation Facility
  – treats collected wastewater, providing a beneficial reuse of a portion of the waste products

Lawrence Collection System and Treatment Plant



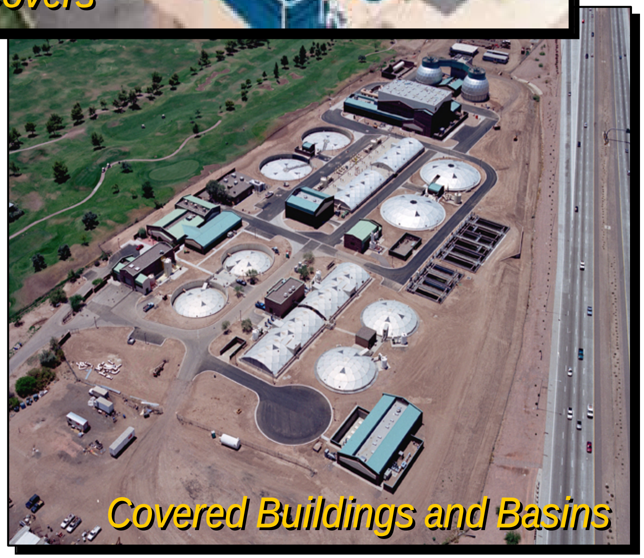
Typical Concerns Associated with Wastewater Treatment

- Generation of Odors
- Aesthetics
- Noise
- Plant and Site Lighting
- Truck Traffic and Disposal of Residuals
- Property Value Impacts
- Others?

Control of Odors

- Minimize odor generation and
  release of hydrogen sulfide (H_2S)
- Effectively cover, ventilate, and scrub


Fabric Covers


Covered Buildings and Basins


Flat Aluminum Covers with External Support

Odor Control Approach:
Apply Appropriate Technologies


Activated Carbon


Chemical Wet Scrubber

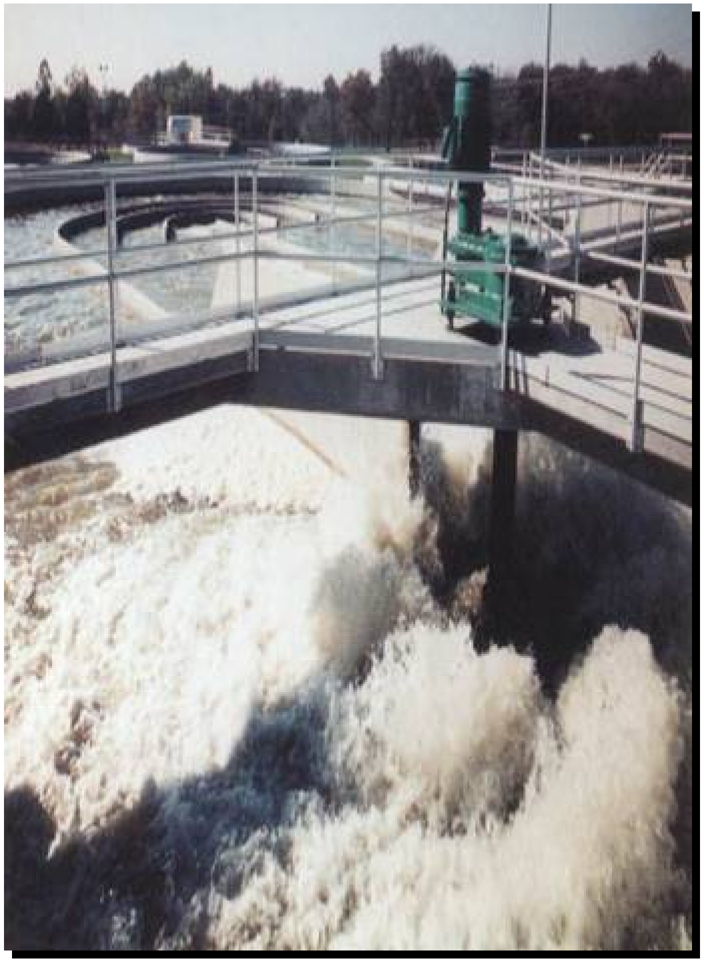

Biotrickling Filter


Chemical Treatment

Functionality and Costs Have Driven Past Site Aesthetics Decisions

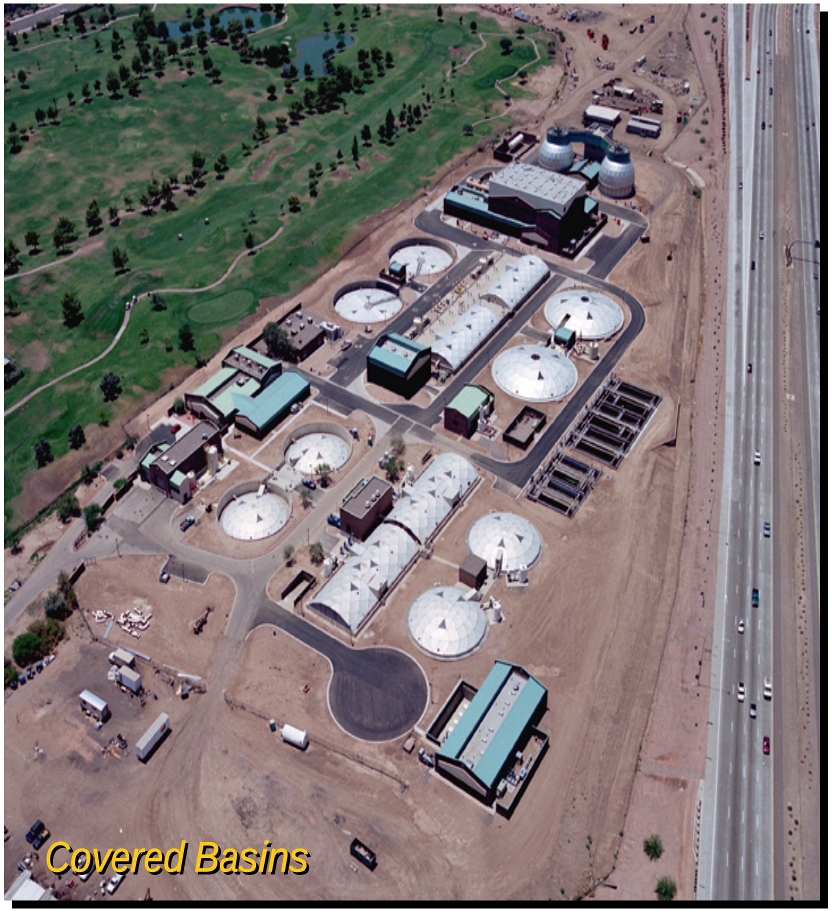
Architectural Styles and Site Utilization Are Limited to Your Imagination and Budget

Process Equipment Does Generate Noise



Methods of Reducing Noise

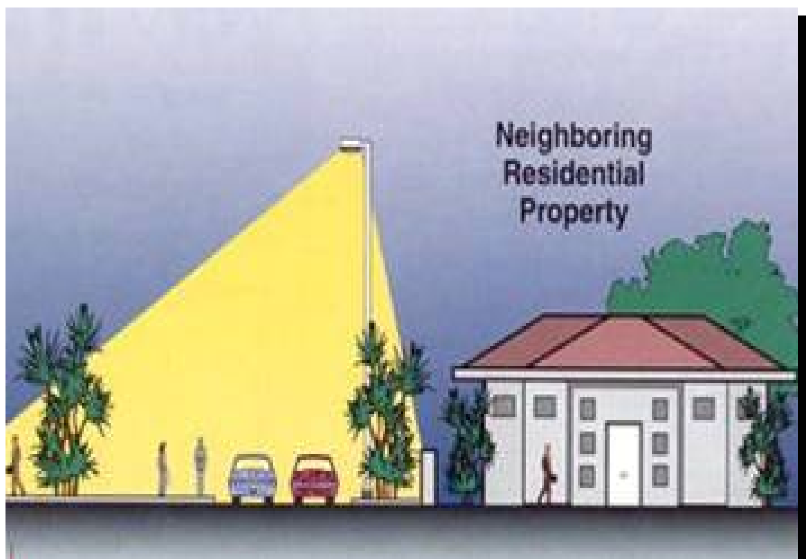
Filter Intake Silencer



Covered Basins

Low Impact Lighting Solutions Are Available

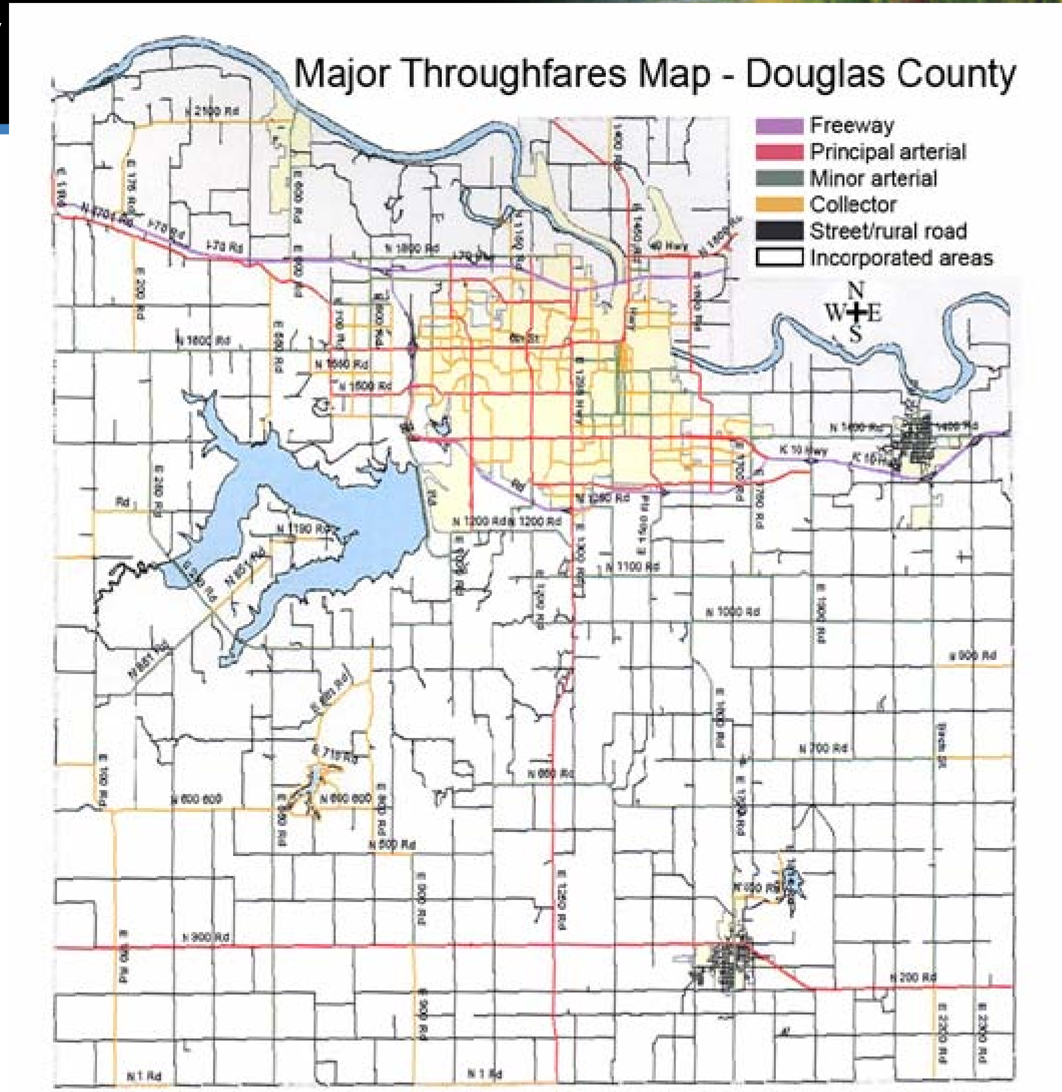
- Screening
- Minimize site lighting
- Choosing appropriate lighting



Increased Truck Traffic and Disposal of Residuals

Provide Good Connectivity with Proposed Facility

- Transportation route
- Pump solids



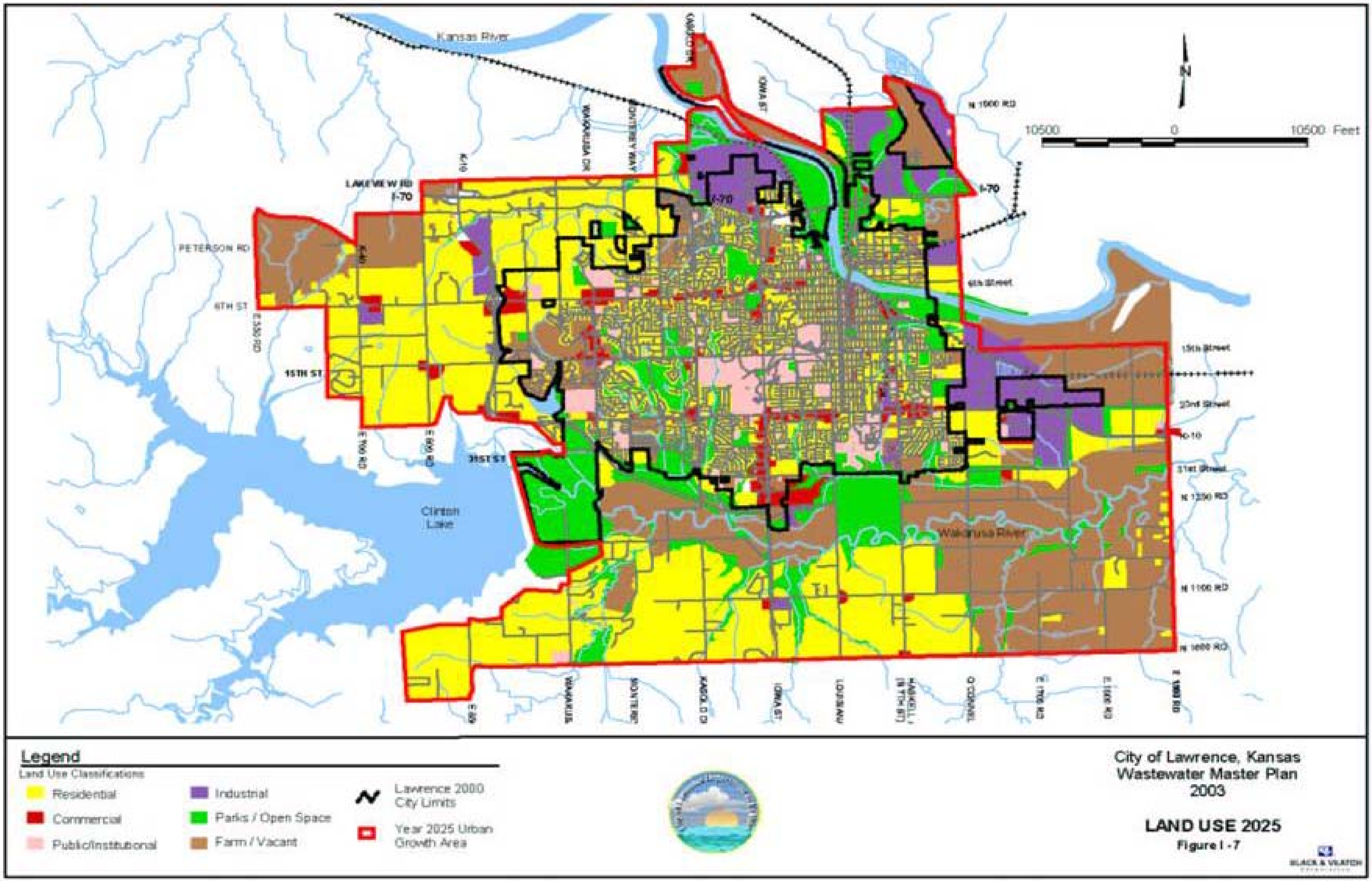
Property Value Impacts

- Decisions we make now will drive degrees of impacts

Why We Are Here Today

- Existing treatment plant nearing capacity
- Forecasted growth rate
- Master Plan recommendations
  - Wakarusa Water Reclamation Facility

2025 Land Use Is Our Beginning Point

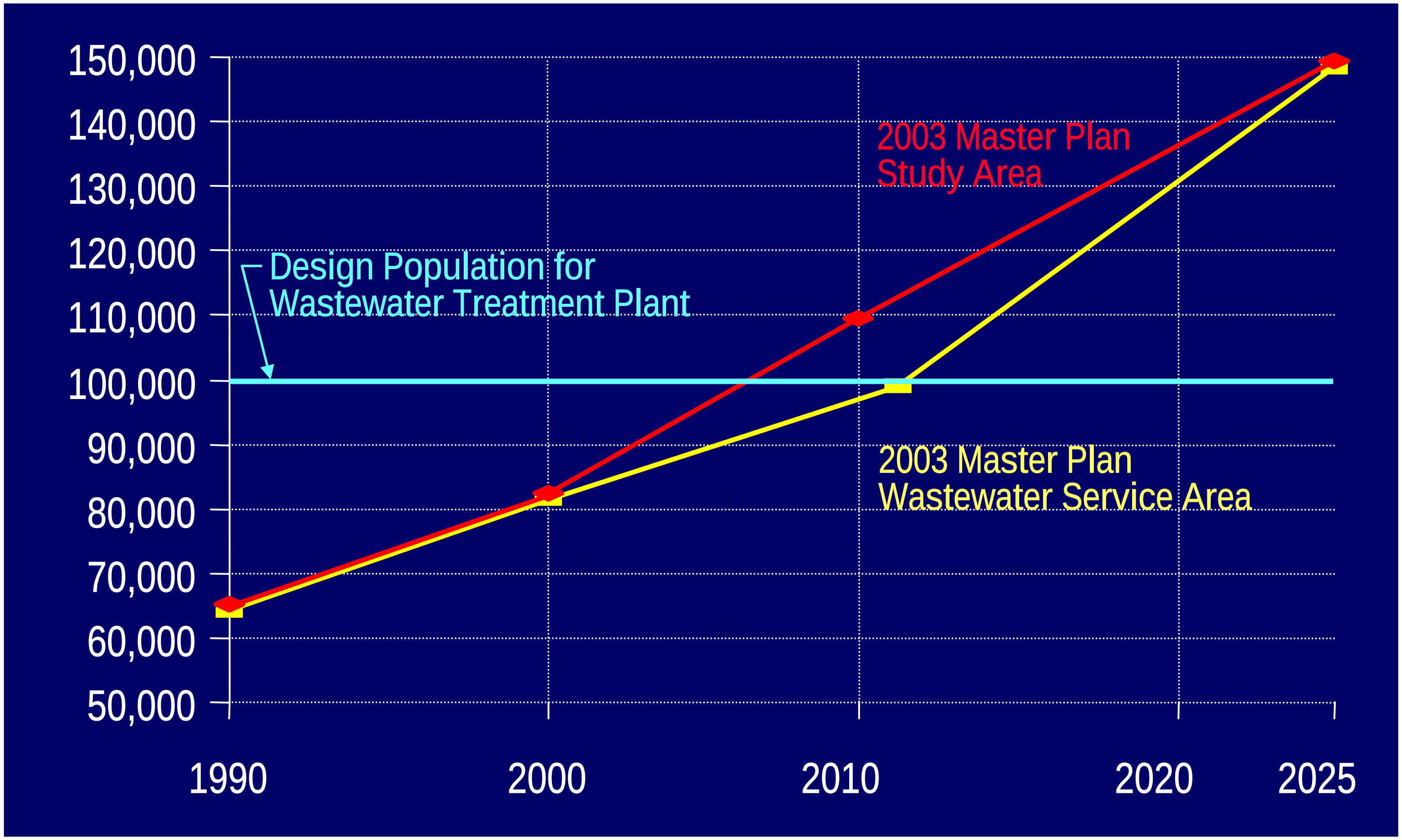


Master Plan Recommendations

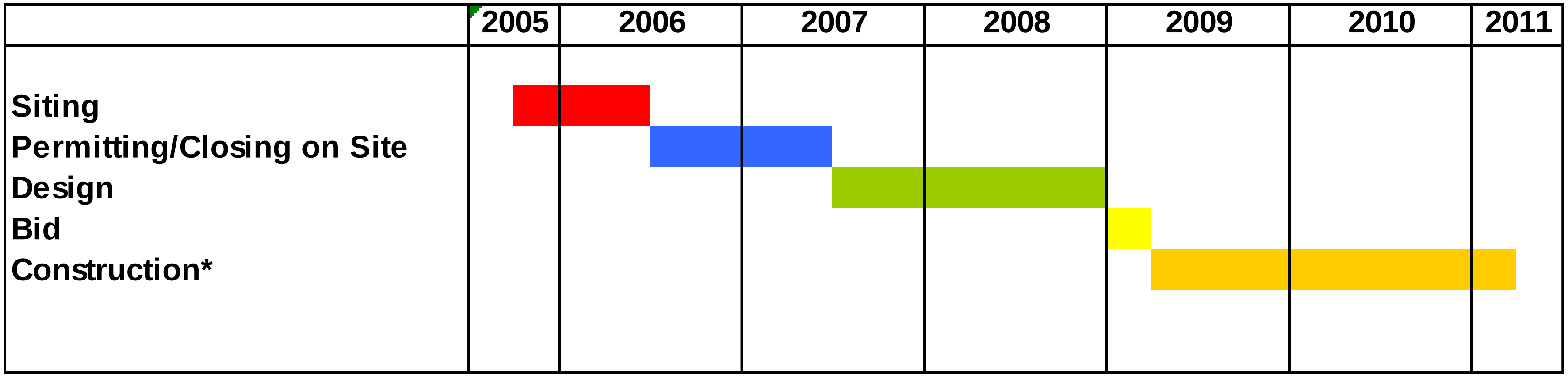
- Construct a new treatment facility to discharge to the Wakarusa River
  - Anticipated effluent limitations are equal for Kansas and Wakarusa Rivers

More cost-effective than transporting all flow to existing plant!

Population Projections



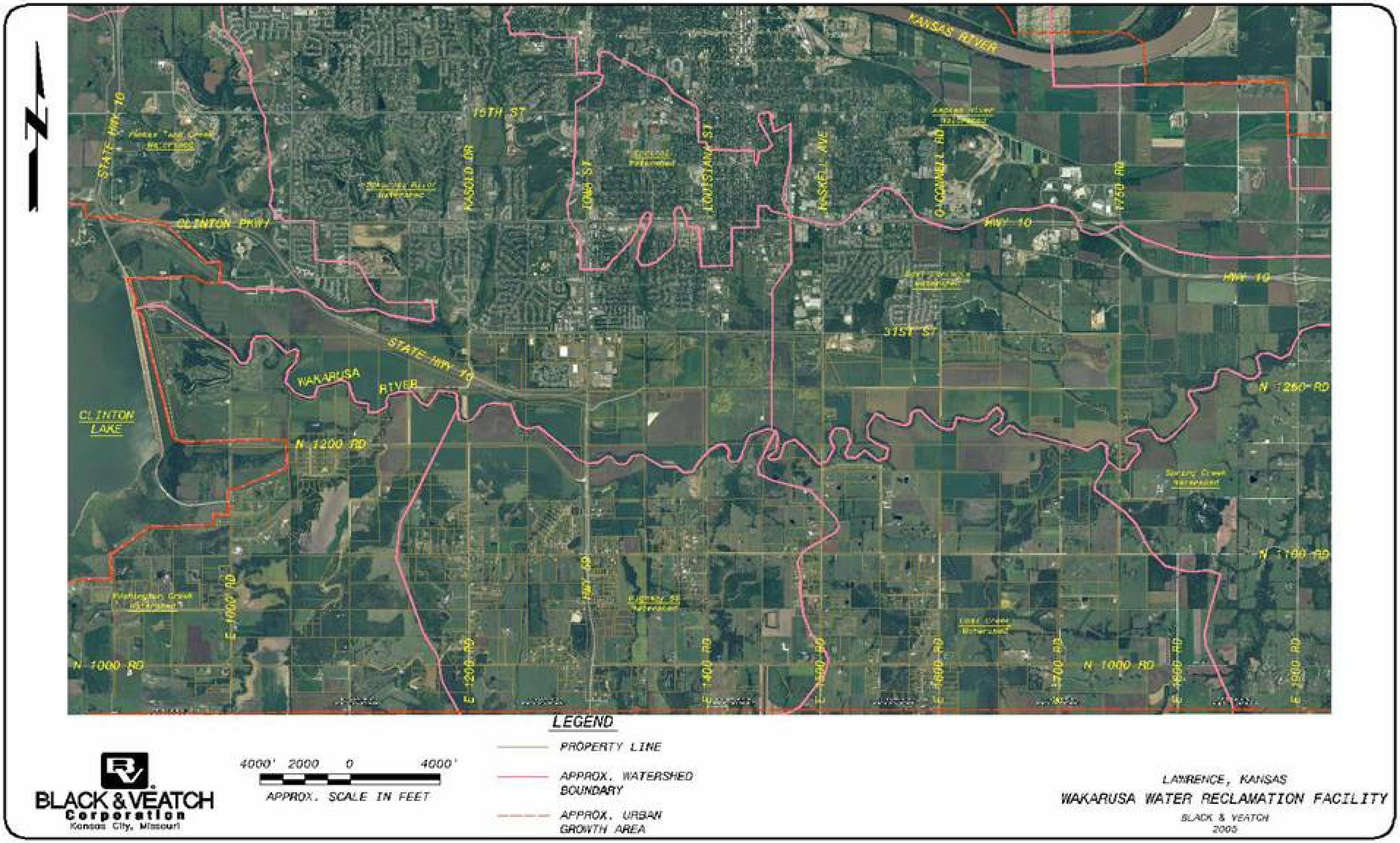
Wakarusa Water Reclamation Facility Timeline



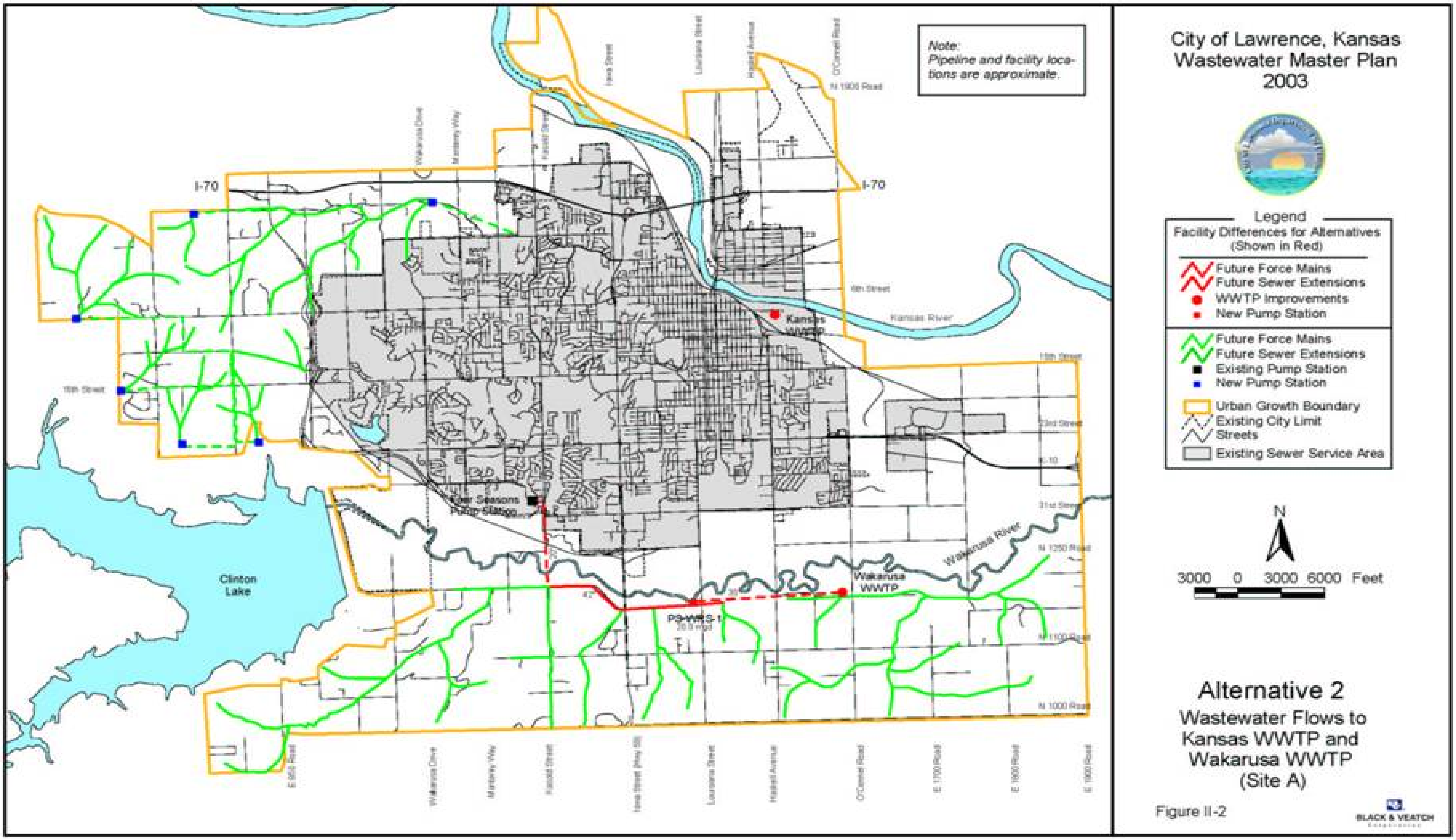
* Construction schedule assumes conventional Design-Bid-Build approach

- Schedule compression required to have facility complete by 2011
  - Site acquisition time reduction
  - Start preliminary design early
  - Consider design/build

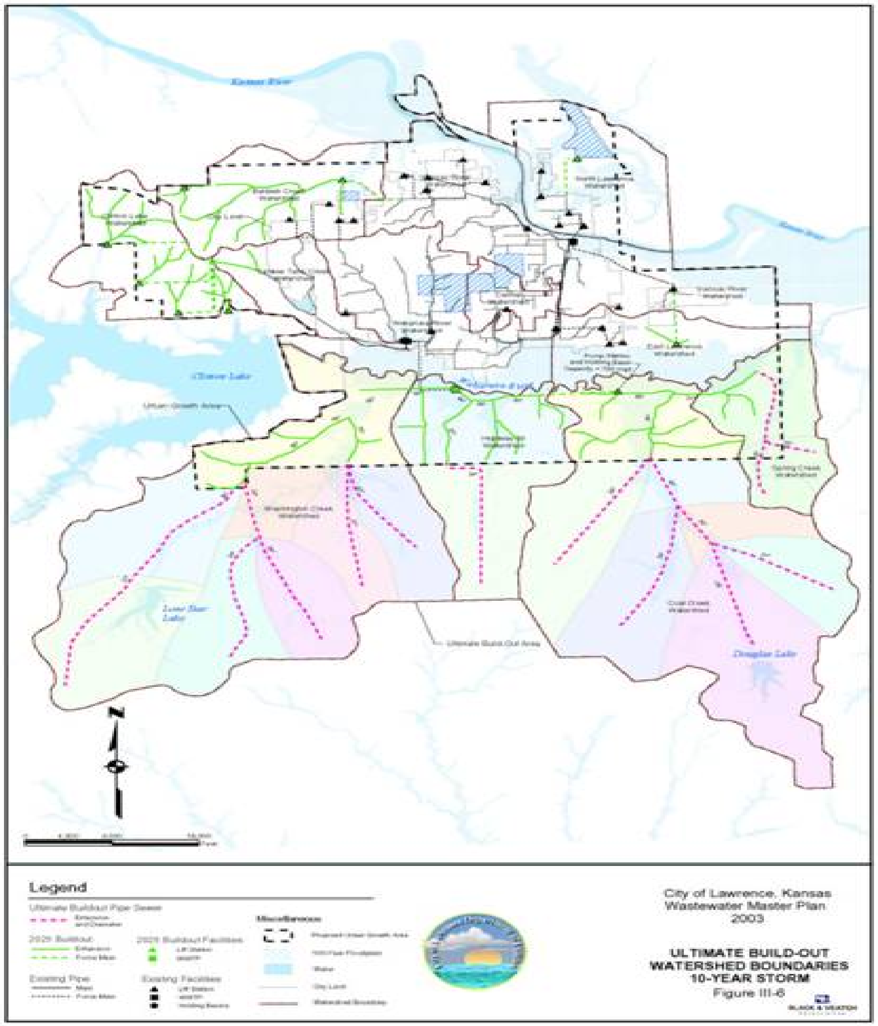
Study Area Considerations



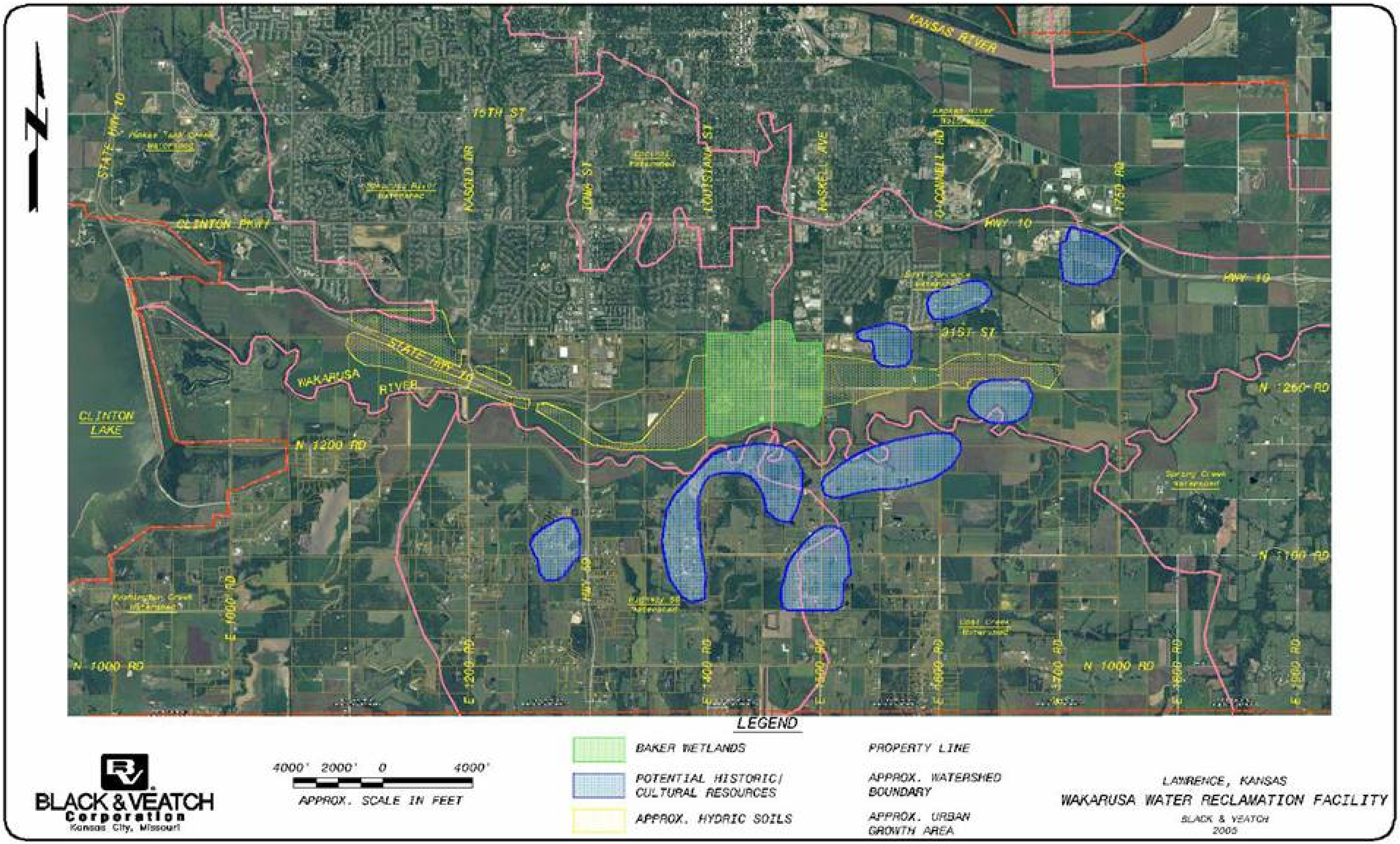
Maximize Use of Existing Collection System



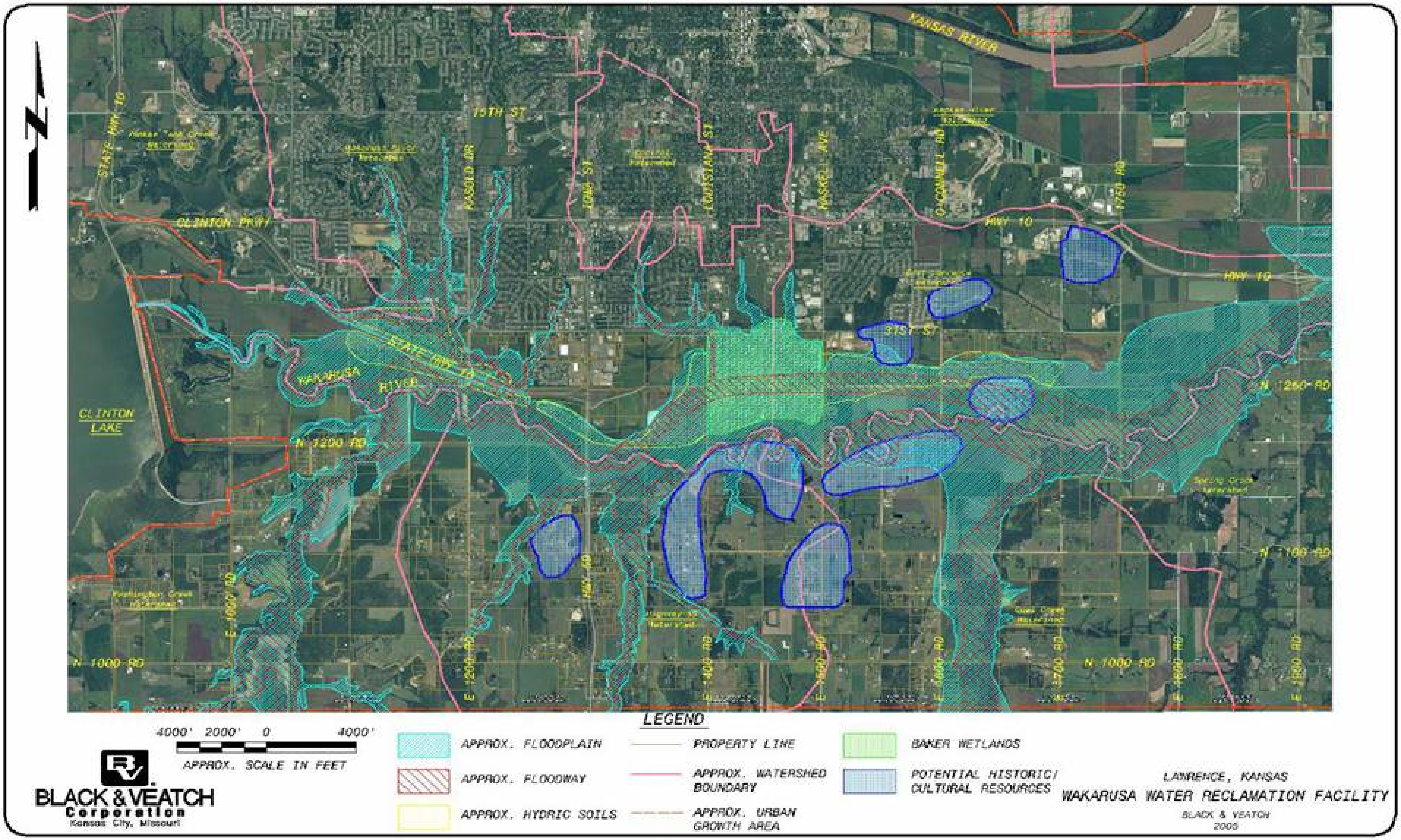
Vision for Ultimate Build-out



Wetlands and Cultural/Historical Considerations



Engineering Issues for Consideration



Engineering Issues for Consideration

- Floodway
- Floodplain
- Environmental permitting
- Site geology
- Site topography
- Proximity to utilities
- Proximity to roadways
- Affordable within rate plan
- Other issues

Public Input into Criteria

- Public acceptability factors
- Site utilization
- Appearance

Stakeholders' participation is vital

Stakeholder Interviews in Progress

- Purpose – Provide background information on which issues are most important to the public
- Range of perspectives sought
  - From Chamber of Commerce to Sierra Club
  - From individual property owners to university representatives
- Status
  - 20 Interviews requested
  - 9 Interviews accepted
  - 6 Interviews conducted thus far

Peer Group

- Dr. Robert Kadlec
  - Renowned expert in wetland treatment
- Dr. Ross McKinney
  - Professor Emeritus, University of Kansas
  - Specialized in wastewater treatment
- Mr. John Metzler
  - Currently Chief Engineer for Johnson County Wastewater
  - Operates three major wastewater treatment facilities within heavy residential areas
  - Former regulatory official at the Kansas Department of Health and Environment.
- Mr. Charlie Stryker
  - President of CAS Construction
  - Expertise in project scheduling and constructability
- Mr. Joe Zoba
  - Chief Executive Officer of Yucaipa Valley Water District, California
  - Holds MPA, which shapes the vision of his utility growth plans

Wakarusa Water Reclamation Facility Study Process

- Study to run through mid-2006

PAC Involvement	*Public-at-large*
PAC Introductory Meeting Overview	Public Meeting No. 1 Overview
Workshop No. 1 Criteria determination	Public Meeting No. 2 Discuss criteria
Workshop No. 2 Apply Criteria to Areas	Public Meeting No. 3 Review Criteria Application
Workshop No. 3 Detailed Criteria Application	Public Meeting No. 4 Final Results

Expectations

- Of PAC members
  - Open feedback of concerns regarding Wakarusa Facility
  - Conduit for public input
  - Challenge relative comparisons of criteria
  - Confirmation of the process
- Of Staff/B&V Team
  - Support for PAC
  - Unbiased evaluations
  - Responsive to PAC/public concerns
  - Confident engineering evaluations

Planned Meetings

Meeting	*Details*	*Purpose*
Public Meeting No. 1	Thursday, November 3 7:00 to 8:30 pm South Junior High	Introduce need for project
Workshop No. 1	TBD Commission Chambers	Initiate evaluations

Group Feedback

- Comments on the proposed public process?
- What other concerns might you foresee?
- Comments on presentation?

MEETING MINUTES

Project: Wakarusa WRF **No.** P-05038
Date: **October 26, 2005**

Wakarusa WRF

Wakarusa WRF Public Advisory Committee (PAC) Meeting #1

Attendance:

Representatives from the Public Advisory Committee, City Staff, and Consultant Team were in attendance at the meeting held in City Hall, Commission Chambers from 4:00 to 5:30 PM.

Public Advisory Committee:

- Allison Reber (Kaw Valley Heritage Alliance)
- Rod Geisler (KDHE)
- Mary Lynn Stewart (Lawrence Preservation Alliance)
- Charles Jones (Douglas County)
- Lavern Squier (Lawrence Chamber)
- Terry Riordan (Planning Commission)
- Laura Calwell (Kansas Riverkeeper, Friends of the Kaw)
- Mike Caron (Save the Wakarusa Wetlands, Inc.)
- Warren Corman (University of Kansas)
- Tom Bracciano (USD 497)
- Roger Pine (Pine family farms/ Kansas Senate)
- Michael Almon (Brook Creek Neighborhood)
- Bobbie Flory (Lawrence Home Builders Association)

City Staff:

- Mike Amyx (City Commissioner)
- Mike Wildgen (City Manger)
- Debbie Van Saun (Assistant City Manager)
- Phillip Ciesielski(Utilities Engineer)
- Lisa Patterson (Communication Manger)
- Mark Hegeman (WWTP Superintendent)

Consultant Team:

- Patti Banks and Lisa Briscoe (Patti Banks Associates)
- Mike Orth, John Keller, and Page Surbaugh (Black & Veatch Corporation)
- John Palsey (HNTB)
- Joe Caldwell (Bartlett & West)

Introduction and Today's Agenda:

- Debbie Van Saun opened the meeting and outlined the day's agenda. Van Saun then turned the meeting over to Patti Banks.

PAC Roles and Responsibilities:

- Banks described the project and noted that the Consultant Team would be working with the City Staff, Peer Group Participants, community stakeholders, and the Public Advisory Committee (PAC) on the development of the ***Wakarusa Water Reclamation Facility (WRF) Study***. She emphasized that the PAC's roles and responsibilities would include the following:
  - Providing input as interested stakeholders
  - Representing their group's interests
  - Serving as a conduit for public input
  - Providing a balance for wants and needs
  - Respecting others' input
  - Respecting the confidentiality of the planning process

Wastewater 101:

- Mike Orth provided a general overview of a typical wastewater collection system and the treatment process. Orth described the differences between a wastewater treatment plant and a water reclamation facility. He noted that wastewater treatment plants treat collected wastewater while reclamation facilities treat collected wastewater and provide a beneficial reuse of a portion of the waste products and/or treat the effluent to a higher quality, depending upon the desired use. He also noted that the City has the opportunity to create an asset at the site by considering multi-use of the surrounding buffer area for the public's use.

Typical Concerns

- Orth summarized Lawrence's current wastewater collection system and treatment plan. He indicated that typical concerns associated with wastewater treatment include:
  - Generation of odors
  - Aesthetics
  - Noise
  - Plant and site lighting
  - Increased truck traffic
  - Disposal of residuals
  - Property value impacts

- John Keller (Black & Veatch Corporation) reviewed typical solutions to classic wastewater treatment issues that may be considered to address public concerns:
  - **Control of Odors**
    - ✓ Minimize odor generation and release of hydrogen sulfide
    - ✓ Consider covering, ventilation, and scrubbing of the most prevalent odor generating facilities
    - ✓ Consider using fabric covers, covered buildings and basins, and flat aluminum covers with external support
    - ✓ Apply appropriate technologies such as, activated carbon, chemical treatment, biotrickling filters, and chemical wet scrubbers
    - ✓ A well operated facility can also be a technique to control the generation of odors as well as purchasing sufficient buffer space to separate the public from the facility.
  - **Aesthetics**
    - ✓ Functionality and costs have traditionally driven past site aesthetic decisions
    - ✓ Architectural styles and site utilization are limited to imagination and budget

- ✓ See Johnson County, Kansas; Scottsdale, Arizona; and Topeka, Kansas for examples

- **Noise**
  - ✓ Process equipment generates noise
  - ✓ Specialized control equipment may be utilized to reduce noise.
  - ✓ Buffer space also controls what noise is heard.

- **Plant and Site Lighting**
  - ✓ Low impact lighting solutions are available
  - ✓ Consider screening, minimizing site lighting
  - ✓ Choosing appropriate lighting

- **Increased Truck Traffic and Disposal of Residuals**
  - ✓ Pick a transportation route that provides good connectivity to the proposed facility
  - ✓ Consider pumping the solids to the existing plant to avoid additional traffic concerns.

- **Property Value Impacts**
  - ✓ Decisions made now will drive the degree of the impact to property values

Project Overview:

Need for a Wakarusa Water Reclamation Facility

- Orth provided a summary of the origin, rationale, and purpose of the Study. He specifically noted that the existing treatment plant is nearing capacity and can accommodate a population basis of approximately 100,000. The City's current population is approaching 90,000. Based upon the growth projections utilized in the ***2003 Wastewater Master Plan***, it is anticipated that the 100,000 population basis will be reached around 2011. As a result of the current plant's capacity and the projected growth, the Master Plan recommends that the City develop the Wakarusa Water Reclamation Facility (WRF).

  - **Horizon 2020/Land Use**
    - ✓ The City's Comprehensive Plan and its growth recommendations for 2025 are the starting point for the Wakarusa WRF.
    - ✓ The Plan recommends that Lawrence plan for growth to the west and south.

  - **2003 Wastewater Master Plan**
    - ✓ The Plan Recommends that a new wastewater facility be constructed that will discharge into the Wakarusa River.
    - ✓ The anticipated effluent limitations would be equal for the Kansas and Wakarusa Rivers based upon the nutrient levels for the rivers. This is a change from previous planning documents where more stringent limits were placed on the Wakarusa than on the Kansas River.
    - ✓ Constructing a Wakarusa WRF is more cost-effective than transporting all the flow and expanding the existing plant.

  - **Growth Rate May Be Exceeding Population Projections**
    - ✓ The design population for the existing wastewater treatment plant is 100,000 people.
    - ✓ Lawrence's 2003 wastewater service area was originally expected to reach the design population around 2011.

- ✓ There is a potential that the overall City growth is occurring at a faster rate, and more densely, than originally forecasted. This may require acceleration of the completion of the Wakarusa WRF project. Therefore, it is important to maintain the planned schedule and improve upon it where feasible.

- o **Timeline**
  - ✓ A compressed schedule that involves reducing site acquisition time, starting preliminary designs early, and considering design build may be necessary to construct the Wakarusa WRF prior to 2011. A construction schedule that utilizes a traditional design/bid/build approach would entail:
    - 2005 – 2006: Siting
    - 2006 – 2007: Permitting/Closing on the site
    - 2007 – 2008: Design
    - Early 2009: Bid
    - 2009 – 2011: Construction

Requirements and Considerations

- Orth noted that a vision for ultimate build-out should be created as a part of the Study. He stressed that no preconceived facility locations had been selected and that gravity flow should be accommodated to the extent possible. Important project constraints include:
  - o Study area considerations related to:
    - ✓ Maximizing the use of the existing collection system
    - ✓ Wetlands, cultural and historic locations
  - o Engineering issues:
    - ✓ Floodway
    - ✓ Floodplain
    - ✓ Environmental permitting
    - ✓ Site geology
    - ✓ Site topography
    - ✓ Proximity to utilities
    - ✓ Proximity to roadways
    - ✓ Affordability within rate plan

Introduction to the Process:

Public Input into the Criteria for Selection

- Banks stated that pubic input related to pubic acceptability factors, site utilization, and appearance would be considered in the criteria for site selection of the water reclamation facility.

Public Advisory Committee (PAC)

- Banks said that the PAC would be engaged with the Project Team throughout the planning process and that they may be requested to stay with the team through 2011.

Stakeholder Interviews

- Banks said that community stakeholders are currently being interviewed and scheduled for interviews. The purpose of the stakeholder interview process is to provide background information on which issues are most important to the public. The interviews seek to gain a range of perspectives about the project and include individuals from the Chamber of Commerce to the

Sierra Club and from individual property owners to University representatives. Thus far, twenty interviews have been requested, nine accepted, and six conducted.

<u>Peer Group Roles</u>

- Banks explained the roles and qualifications of the Peer Group participants as follows:
  - **Dr. Robert Kadlec**
    - ✓ Renowned expert in wetland treatment
  - **Dr. Ross McKinney**
    - ✓ Professor Emeritus, University of Kansas
    - ✓ Specialized in wastewater treatment
  - **Mr. John Metzler**
    - ✓ Currently Chief Engineer for Johnson County Wastewater
    - ✓ Operates three major wastewater treatment facilities within heavy residential areas
    - ✓ Former regulatory official at the Kansas Department of Health and Environment
  - **Mr. Charlie Stryker**
    - ✓ President of CAS Construction
    - ✓ Expertise in project scheduling and constructability
  - **Mr. Joe Zoba**
    - ✓ Chief Executive Officer of Yucaipa Valley Water District, Columbia
    - ✓ Holds MPA, which shapes the vision of his utility growth plans

<u>Process Timeline</u>

- Banks said that it was anticipated that the study would run through mid-2006 and that during that period there would be PAC meetings and public meetings as follows:

<u>PAC Introductory Meeting</u> Overview	<u>Public Meeting No. 1</u> Overview
<u>Workshop No. 1</u> Criteria determination	<u>Public Meeting No. 2</u> Discuss criteria
<u>Workshop No. 2</u> Apply Criteria to Areas	<u>Public Meeting No. 3</u> Review Criteria Application
<u>Workshop No. 3</u> Detailed Criteria Application	<u>Public Meeting No. 4</u> Final Results

<u>Expectations</u>

- Banks outlined the expectations for PAC members, City Staff, and the Consultant Team.
  - **PAC Members**
    - ✓ Be open to feedback about concerns related to the proposed Wakarusa facility
    - ✓ Be the conduit for public input

- ✓ Challenge relative comparisons of the sites
- ✓ Confirm the process

- o **City Staff and the Consultant Team**
  - ✓ Serve as support for the PAC
  - ✓ Provide unbiased evaluations
  - ✓ Be responsive to PAC and public concerns
  - ✓ Supply confident engineering evaluations

Planned Meetings

- Banks explained that the next set of meetings would be as follows:
  - o Public Meeting No. 1:
    - ✓ Thursday, November 3, 2005 at South Junior High School from 7:00 p.m. to 8:30 p.m. to introduce the need for the project to the public.
  - o PAC Workshop No. 1:
    - ✓ Tuesday, November 15, 2005 at the 8th Street Wastewater Treatment Plant conference room from 4:30 to 7:30.

Group Feedback:

Open Discussion of Process and Improvement Potential

- Orth opened the meeting for discussion to the Committee for comments regarding the public process, other foreseen concerns, and comments on the day's presentation. The Committee commented that:
  - o Readable maps should be provided for PAC members
  - o Group needs to consider facility security concerns
  - o It is questionable how floodplain issues can be planned for when modeling when the modeling reflects proposed land uses.
  - o How much of the 6.9 million gallons of sewer treatment plant capacity is taken up by existing sewage transfers from basin to basin?
  - o Can we link treatment alternatives with improving water quality on Wakarusa?
  - o Drinking water supply should be linked to storm sewer treatment demand
  - o Information related to capacity and growth projections should be provided to PAC members.
  - o Topography change from Four Seasons Pump Station to E.1750 Road.
  - o Population projections west and south

Next Meeting

- The next PAC meeting will be held November 15th at 4:30 to 7:30 PM at the 8th Street Wastewater Treatment Plant. Information about optional tour arrangements will be distributed at a later time.

Wakarusa WRF

MEETING AGENDA

Project: Wakarusa WRF
Date: November 15, 2005
Re: **Public Advisory Committee (PAC) Workshop #1**

❒ **Meeting Objectives** (PBA)	**5 minutes**

- Review PAC Questions & Responses
- Review Public Meeting No. 1 & Questionnaire Responses
- Review Evaluation Criteria

❒ **PAC Questions & Responses From Introductory Mtg** (MGO)	**10 minutes**

- Review questions & responses

❒ **Overview of Recent Haskell Meeting** (JAK)	**5 minutes**

- Summarize meeting

❒ **Review Stakeholder Summary Report (**PG)	**15 minutes**

- Review stakeholder interview findings

❒ **Review Criteria Questionnaire Results** (MGO)	**30 minutes**

- Review PAC, staff & consultant ratings

❒ **Public Meeting No. 1 Questionnaire Results** (PBA)	**10 minutes**

- Review responses
- Review publics responses relative to PAC/Staff criteria
- Review stakeholder responses relative to PAC/Staff criteria (PG)
- Need to adjust criteria results?

❒ **Review Decision Hierarchy** (MGO)	**10 minutes**

- Review Criterion Decision Plus Model

❒ **Group Breakout** (Groups)	**20 minutes**

- Breakout into assigned groups
- Review criteria from your groups viewpoint
- Report groups views on criteria weighting
- Need to enhance criteria definitions more

❒ **Open Discussion/Feedback**	**10 minutes**

❒ **Next PAC Meeting Date**

- January 10, 2006 from 4:30 to 7:30 @ WWTP Conference Room?

Wakarusa Water Reclamation Facility
PAC Workshop No. 1

November 15, 2005
4:30 to 6:30 pm

Kaw River WWTP

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Agenda

- Today's Meeting Objectives
- PAC Questions & Responses
- Overview of Recent Haskell Meeting
- Review Stakeholder Summary Report
- Review Criteria Questionnaire Results
- Review Public Meeting No. 1 Questionnaire Results
- Review Decision Hierarchy
- Group Breakout
- Open Discussion/Feedback

PAC Questions & Answers Discussion

Overview of Recent Haskell Meeting

"Snow Ball Effect"

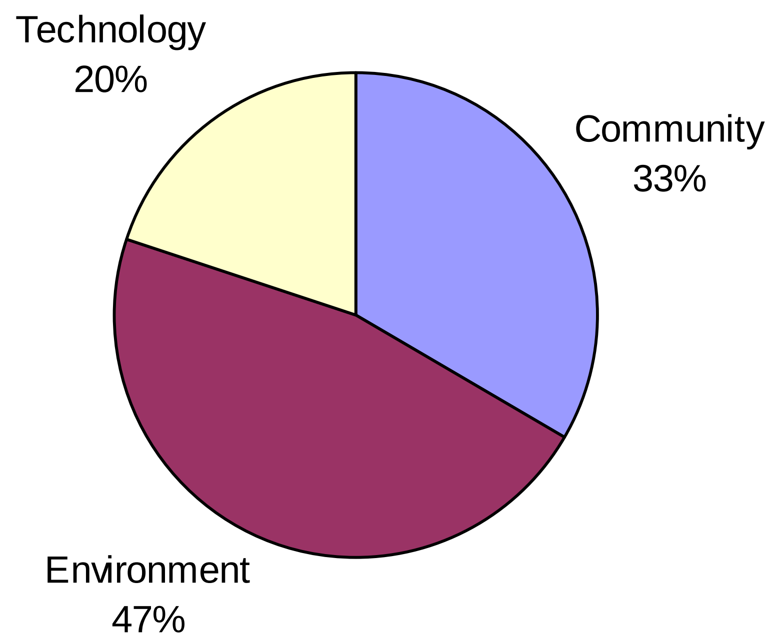
- John Keller of Black & Veatch attended meeting
- Other discussions

Review Stakeholder Summary Report

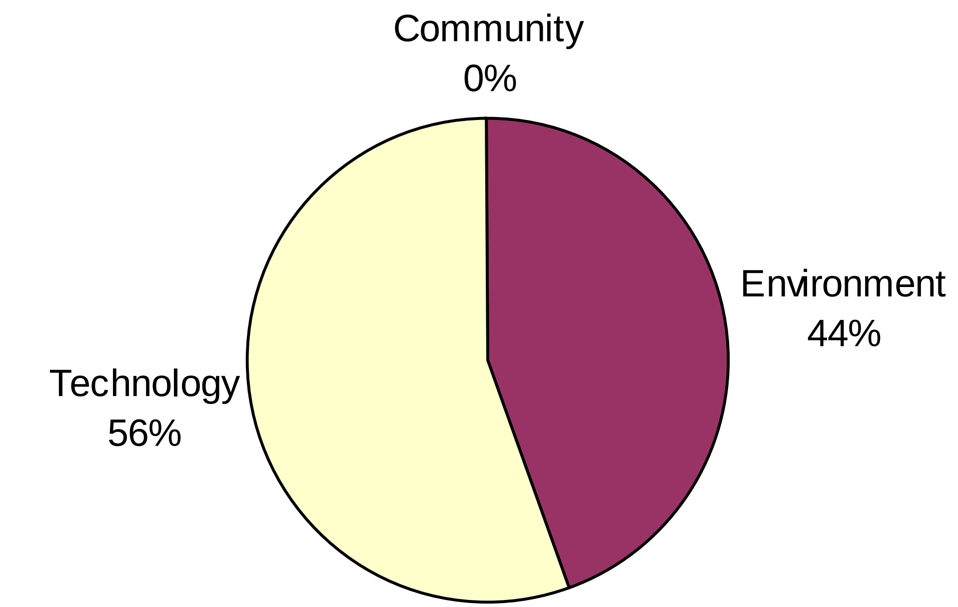
- Prepared by Patty Gentrup of Olsson Associates

Review Criteria Questionnaire Results

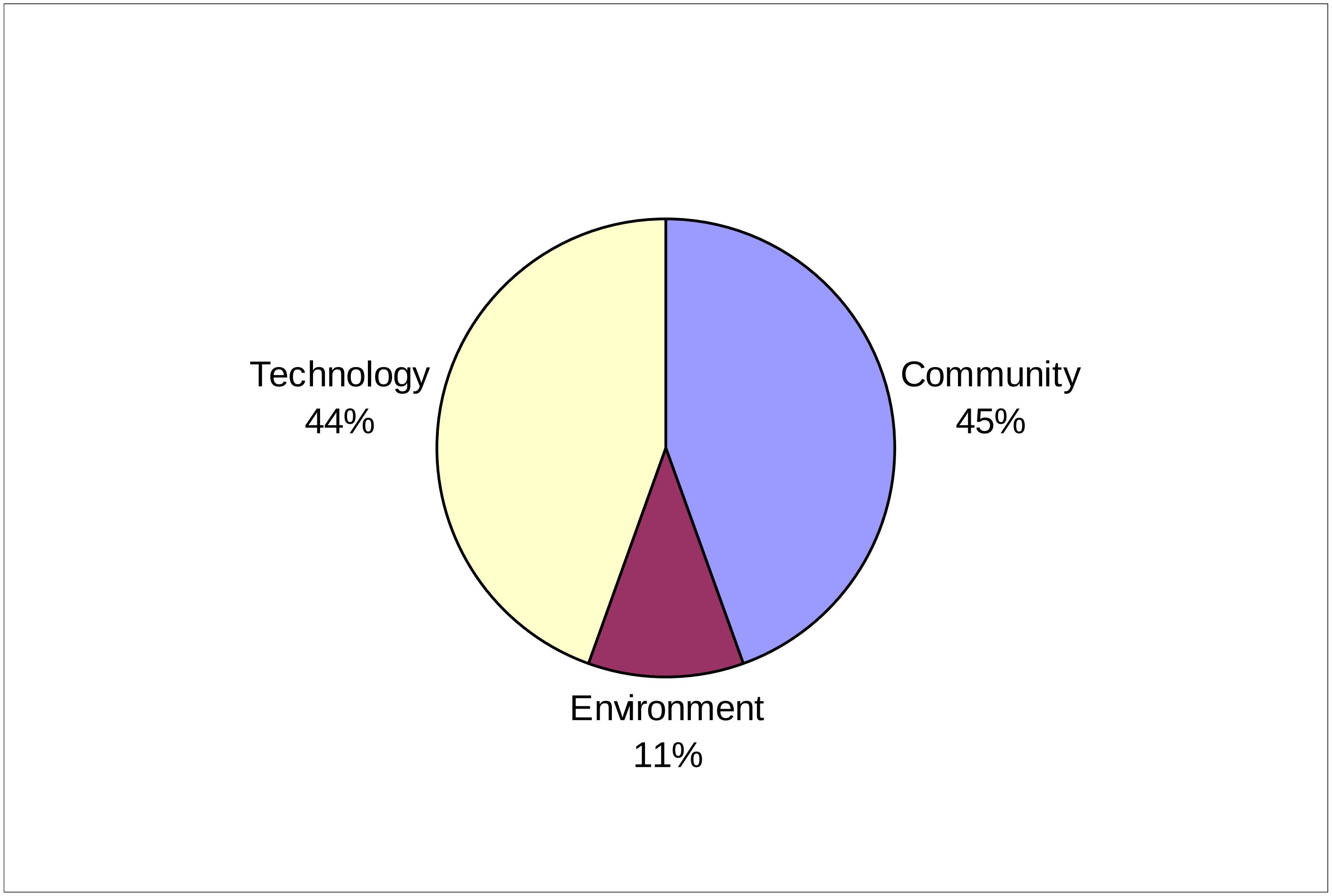
Primary Criteria
PAC



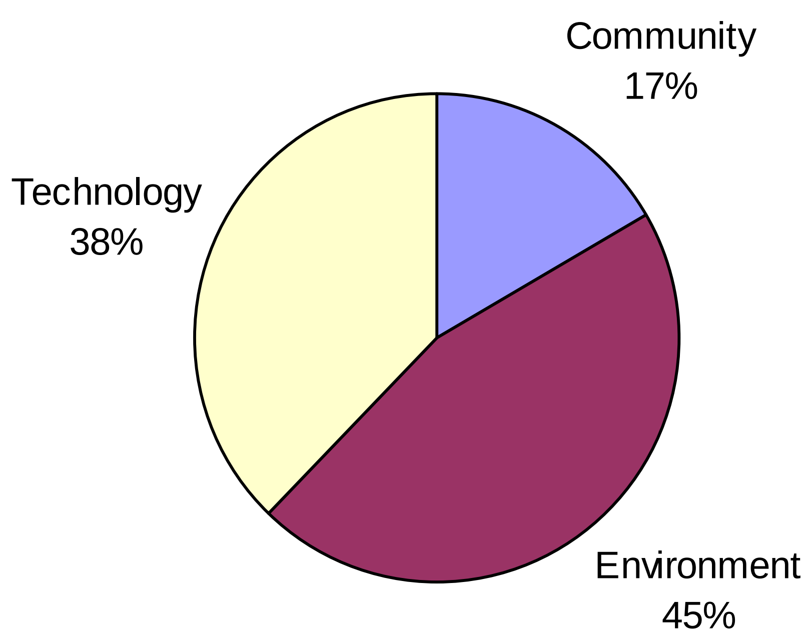
Primary Criteria
Staff



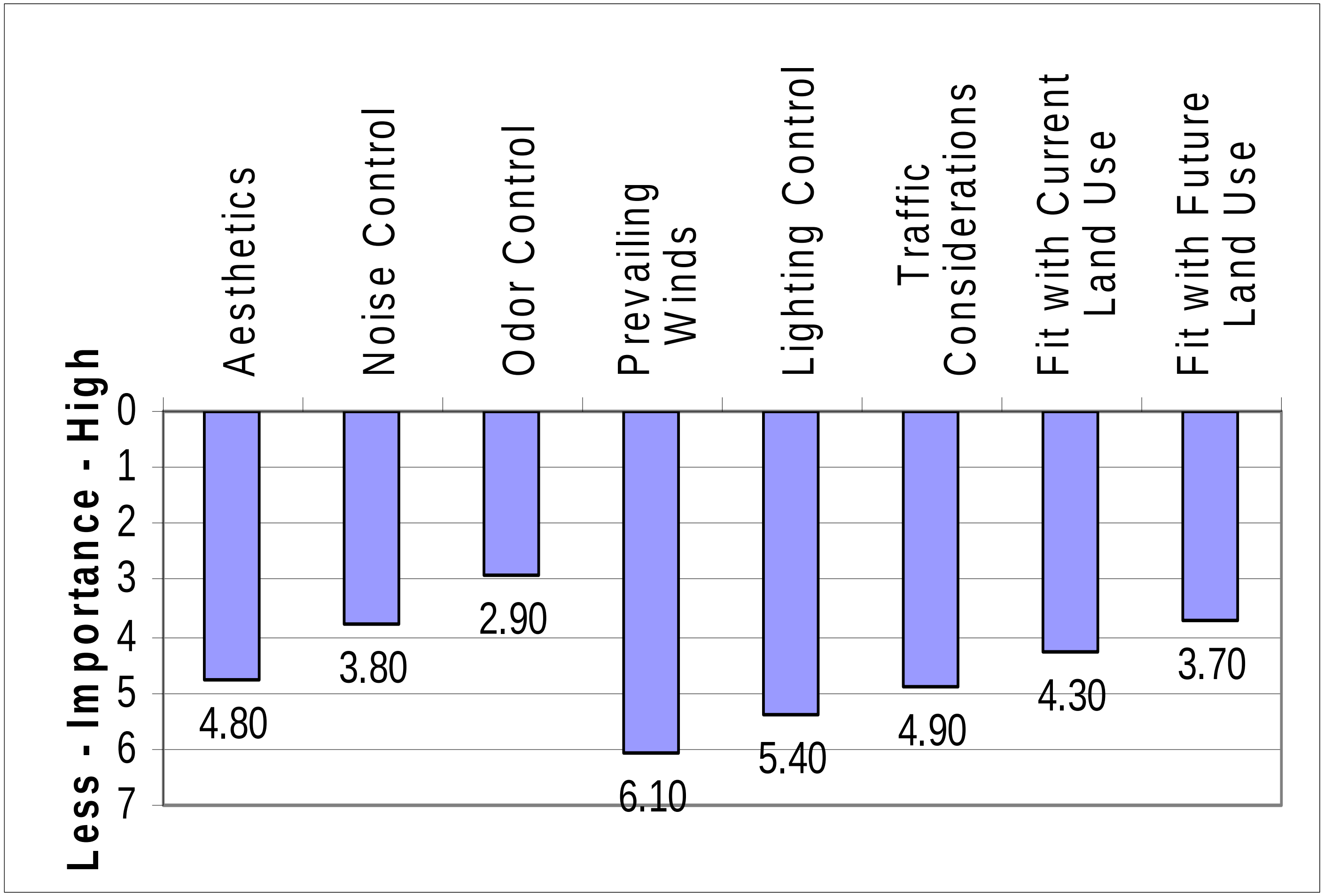
Primary Criteria
Consultants



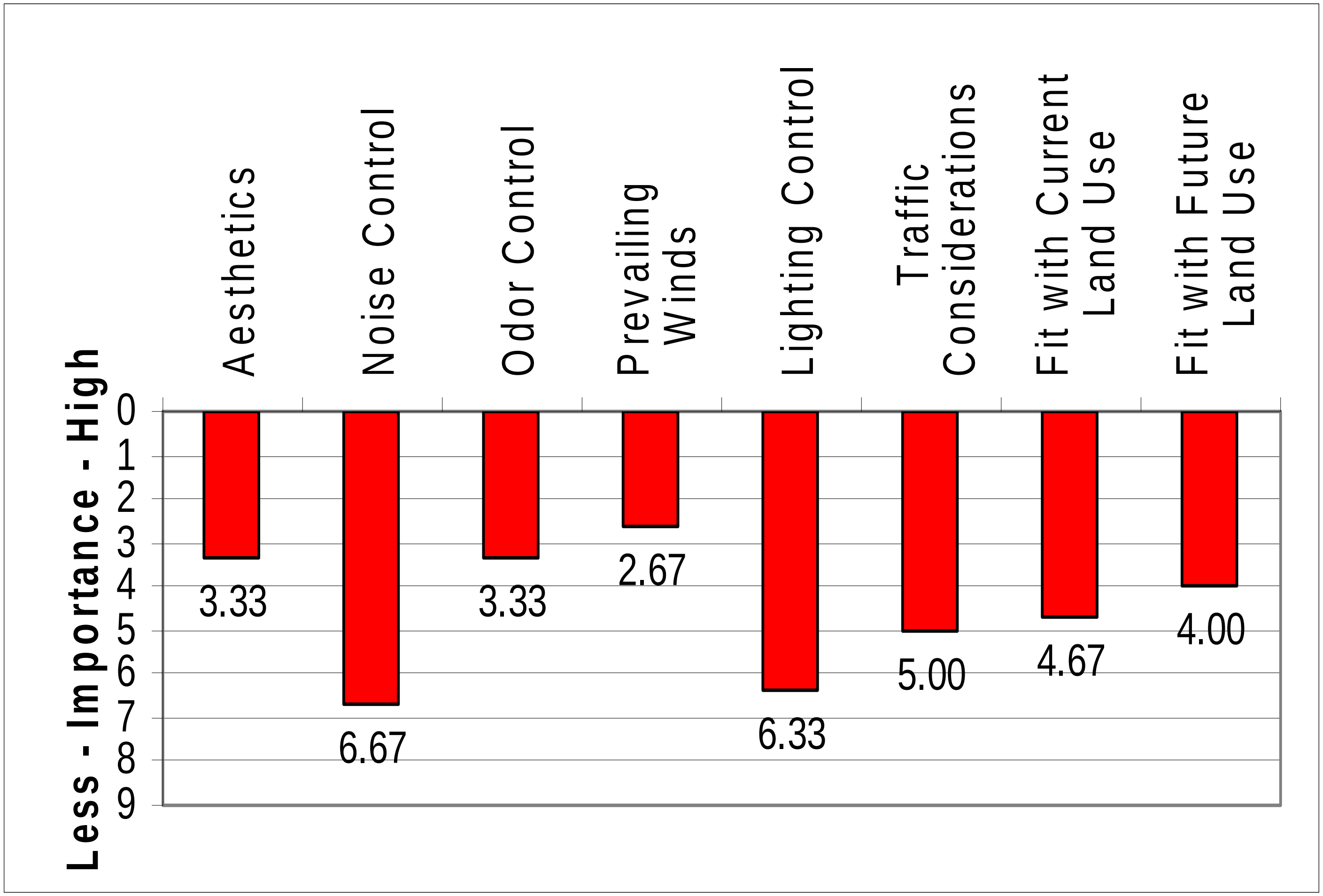
Primary Criteria
Average: PAC/Staff



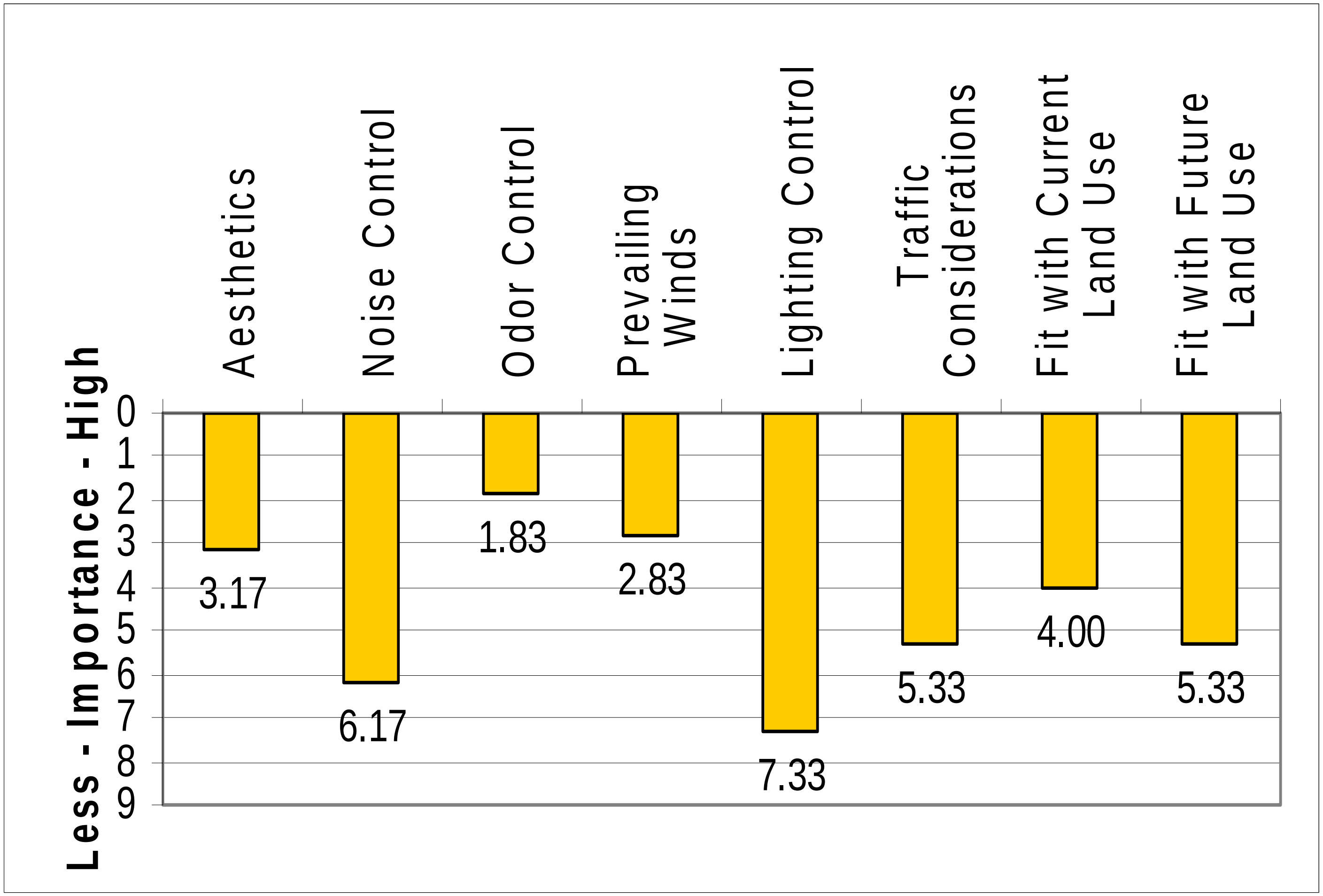
Community Sub-criteria
PAC



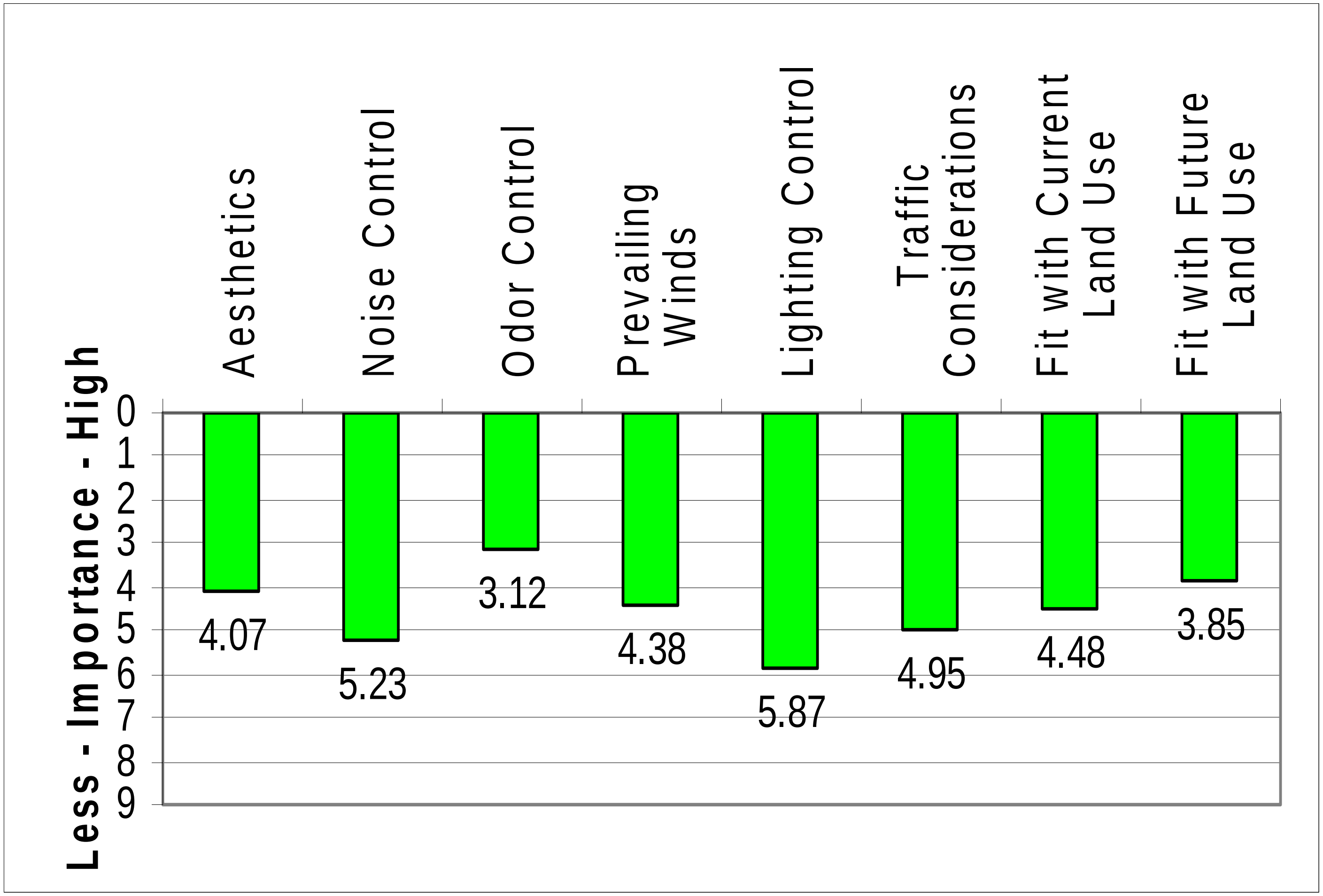
Community Sub-Criteria
Staff



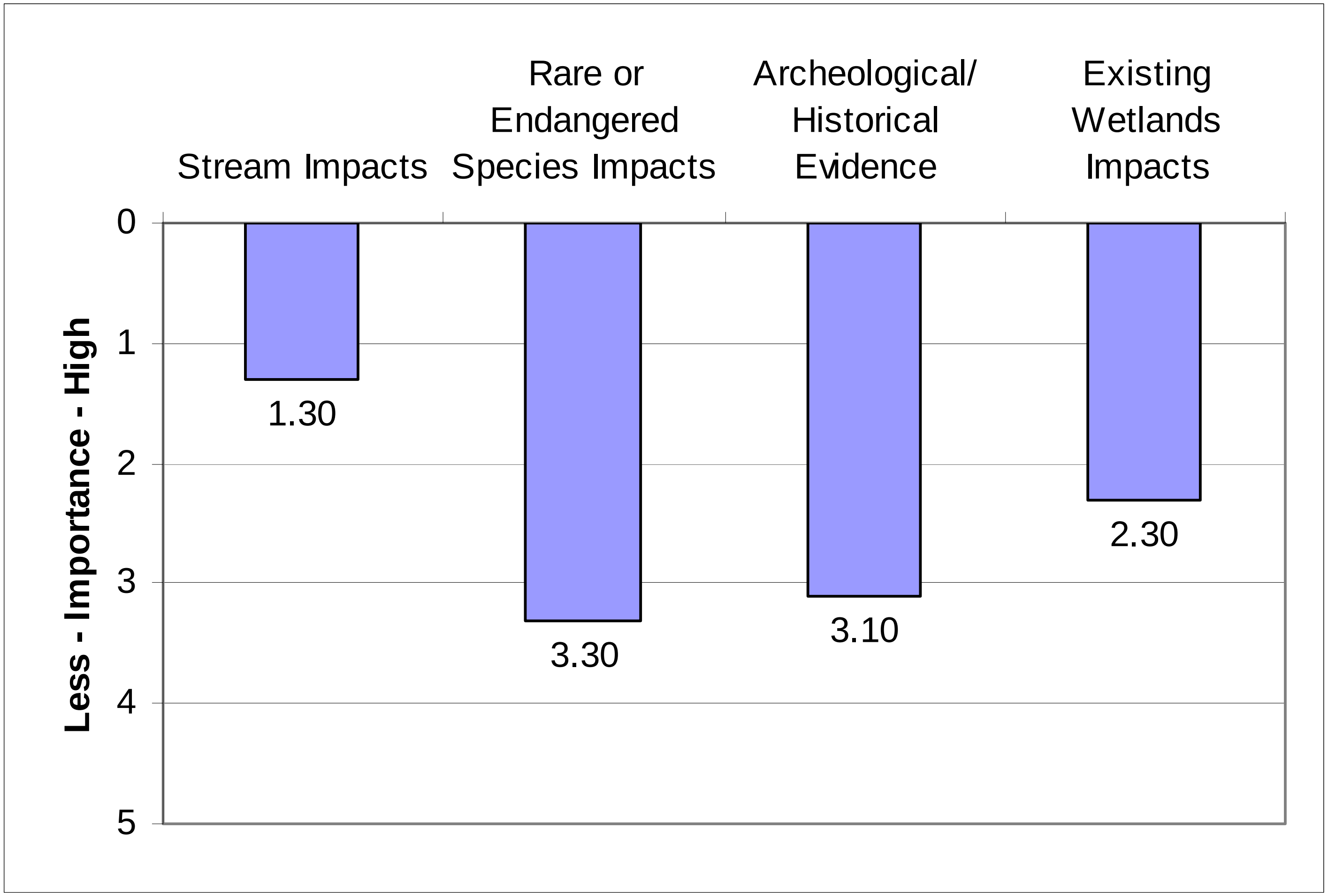
Community Sub-Criteria
Consultant



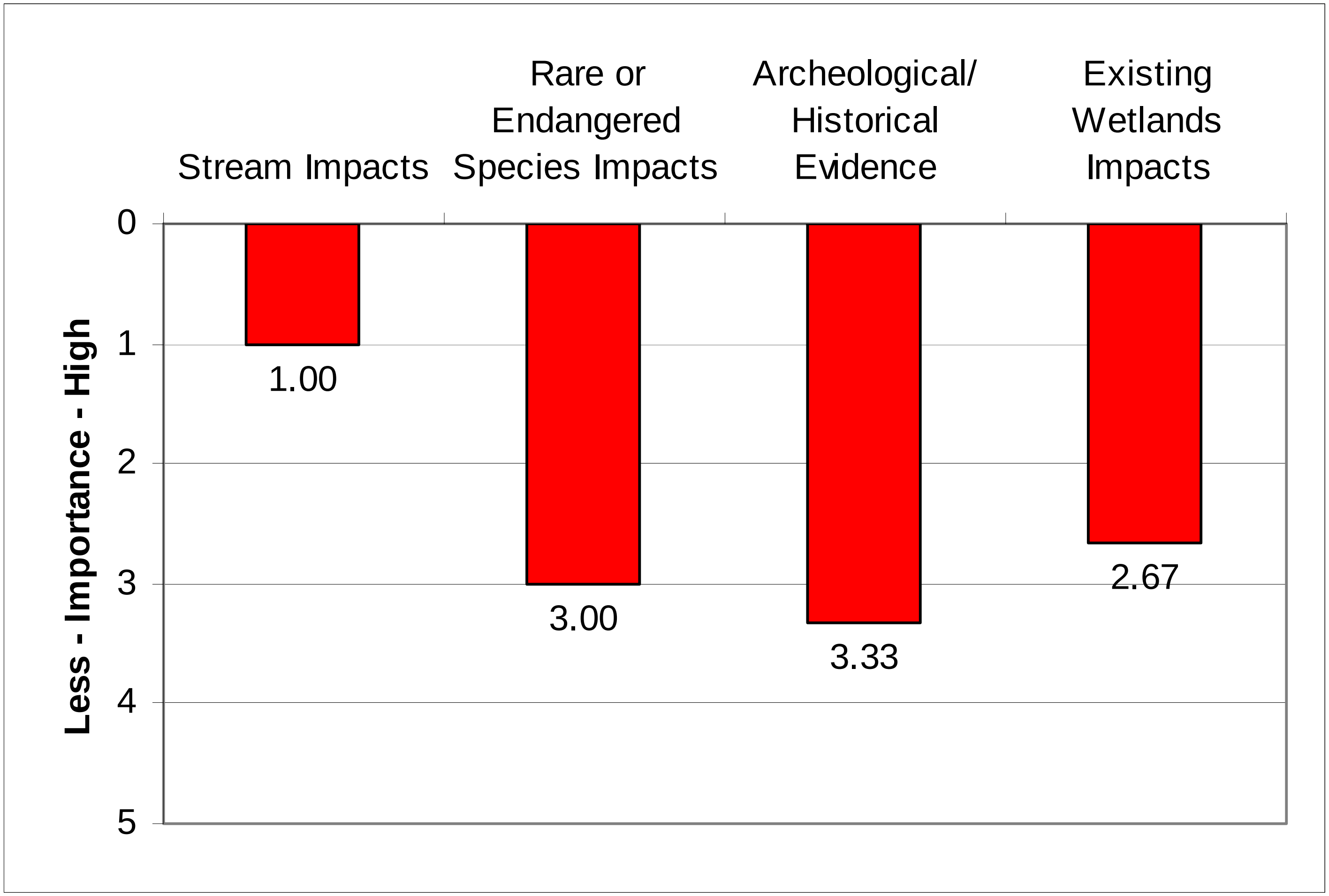
Community Sub-Criteria Average: PAC/Staff



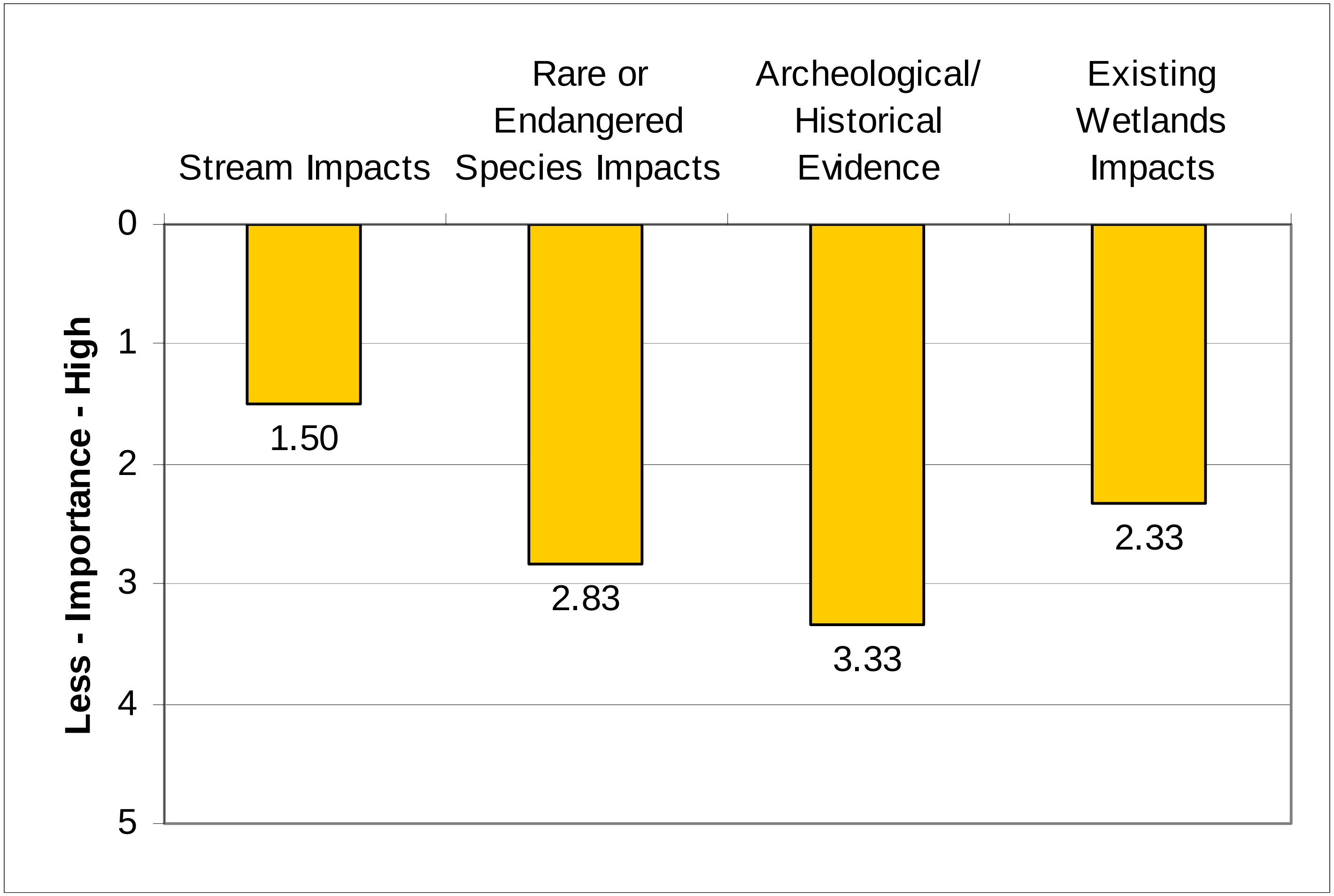
Environment Sub-Criteria PAC



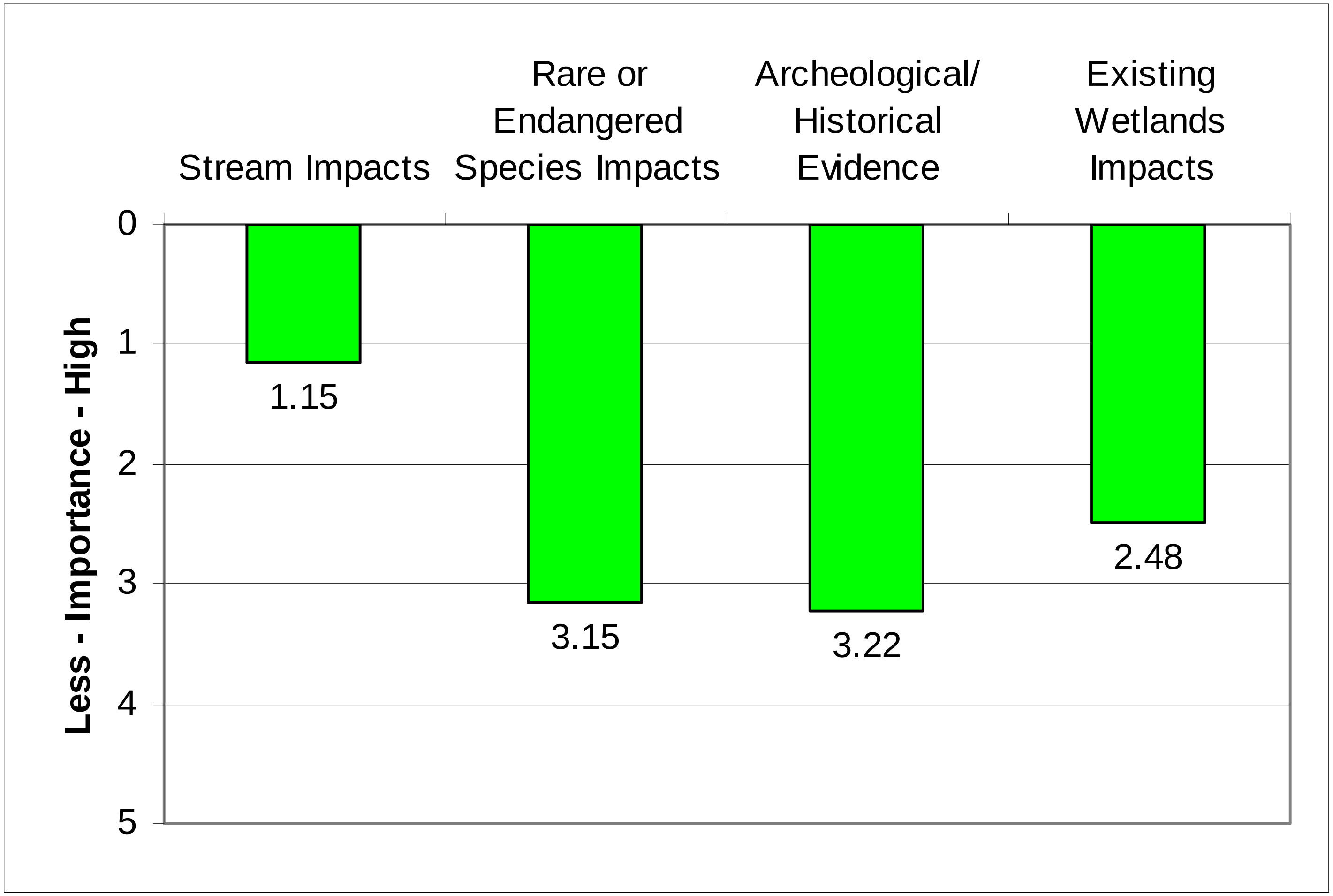
Environment Sub-Criteria
Staff



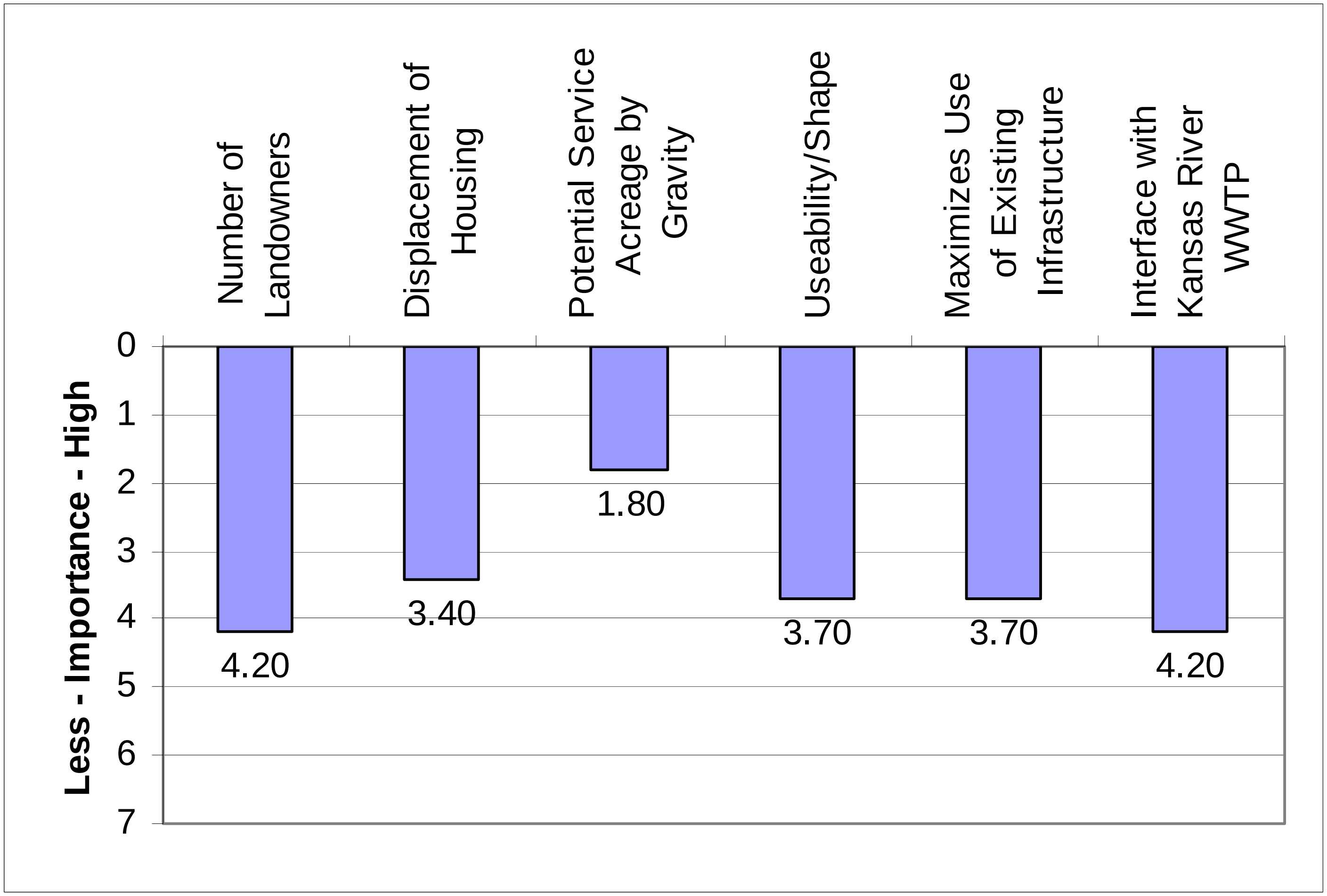
Environment Sub-Criteria Consultant



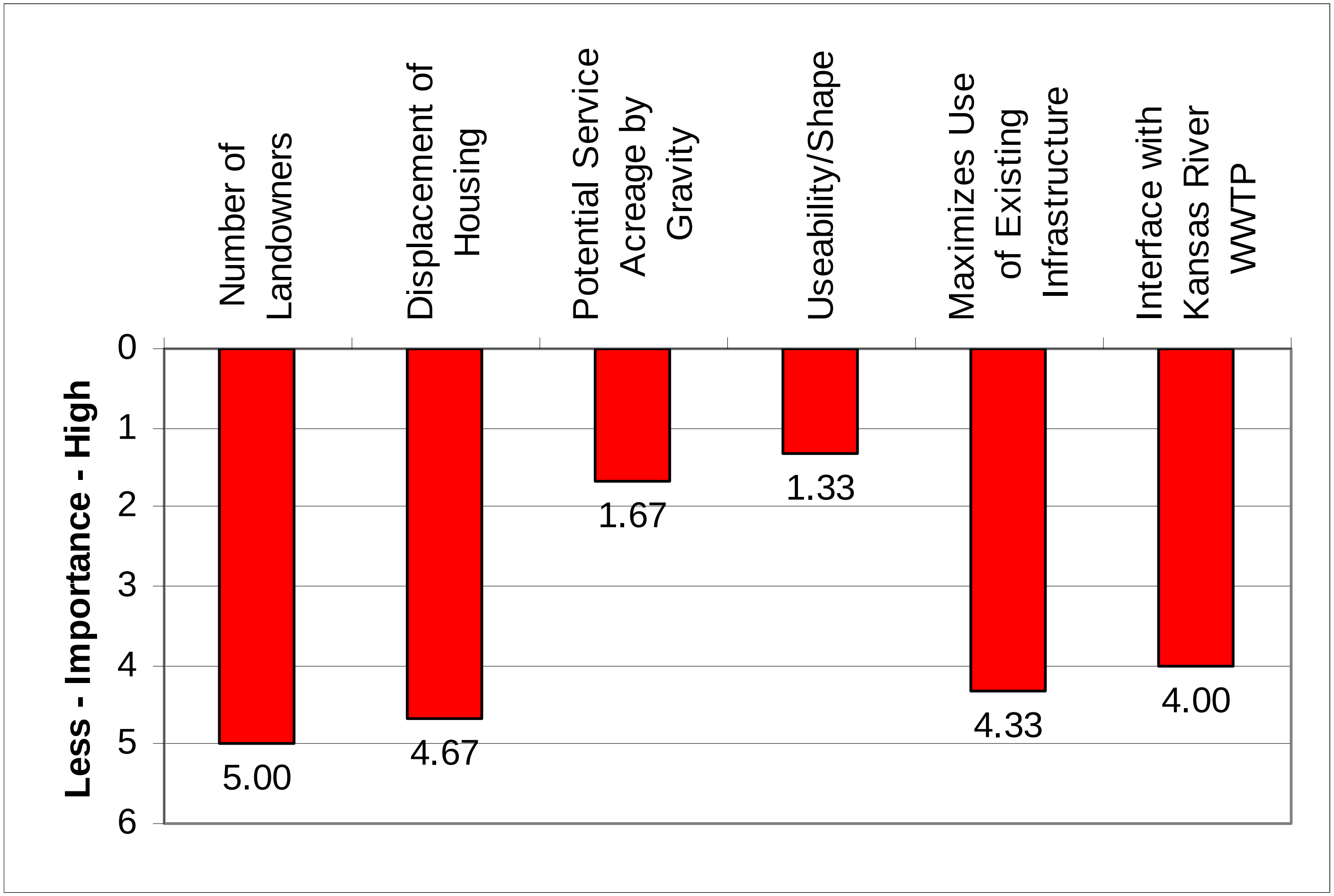
Environment Sub-Criteria Average: PAC/Staff



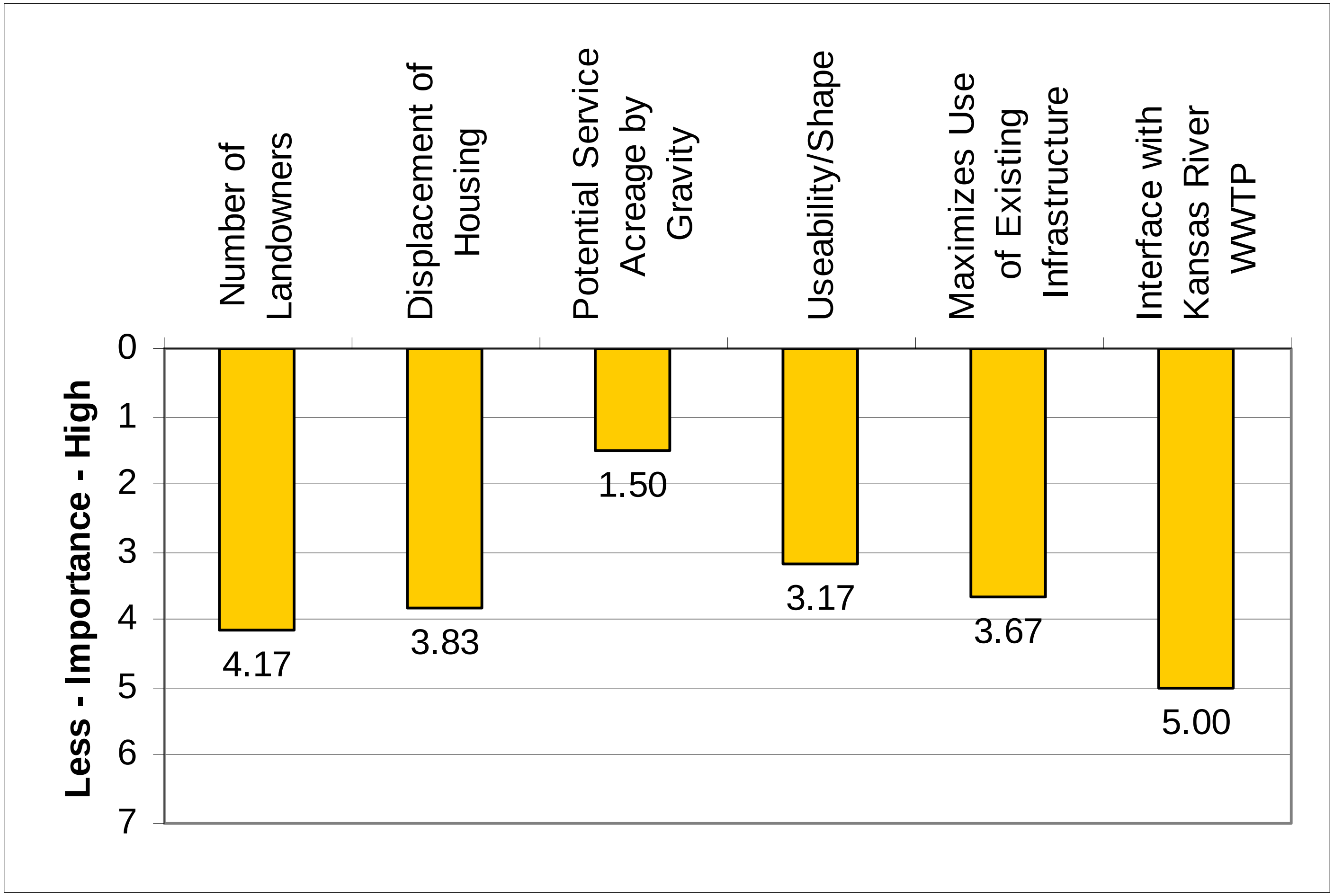
Technology Sub-criteria - Land
PAC



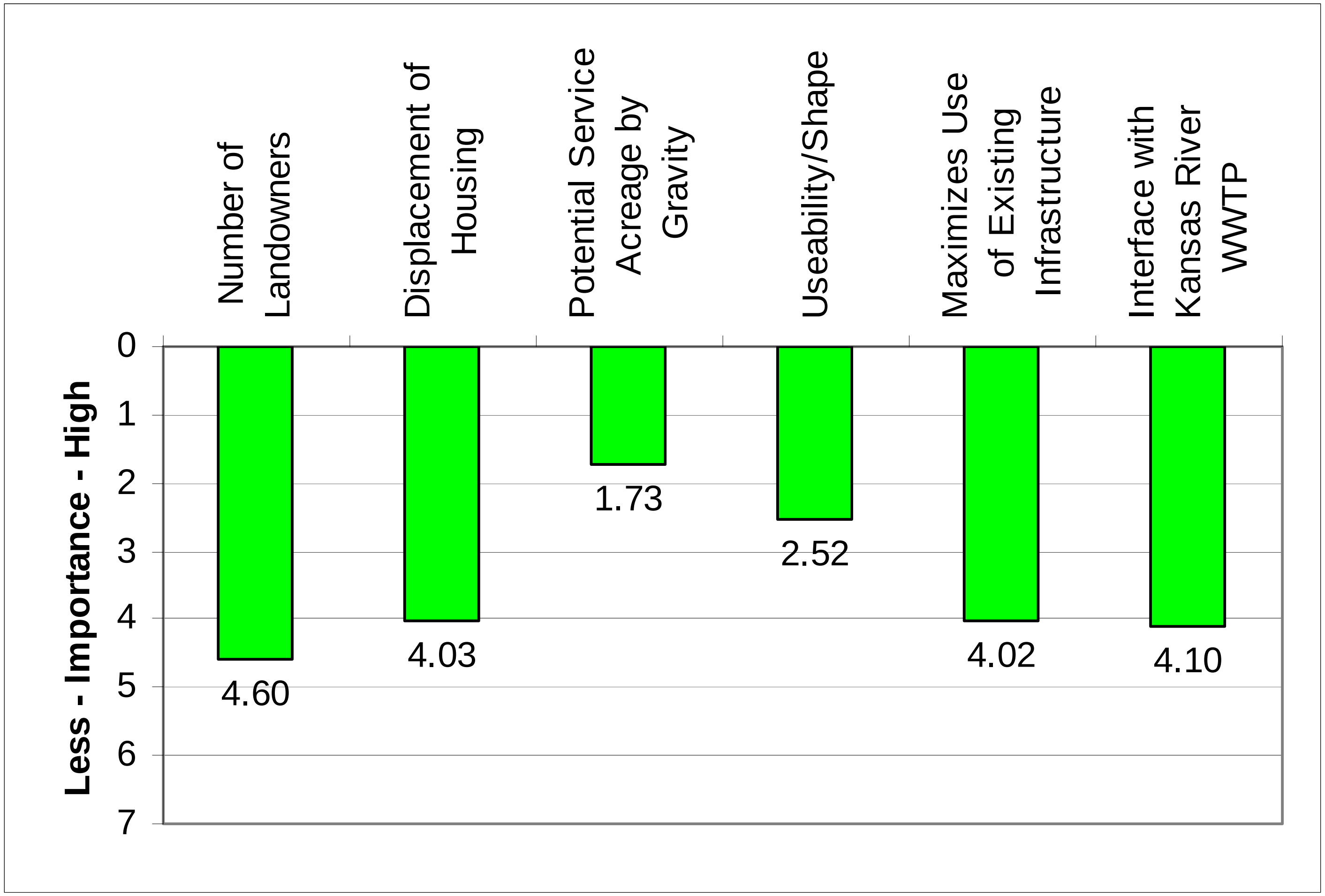
Technology Sub-criteria - Land
Staff



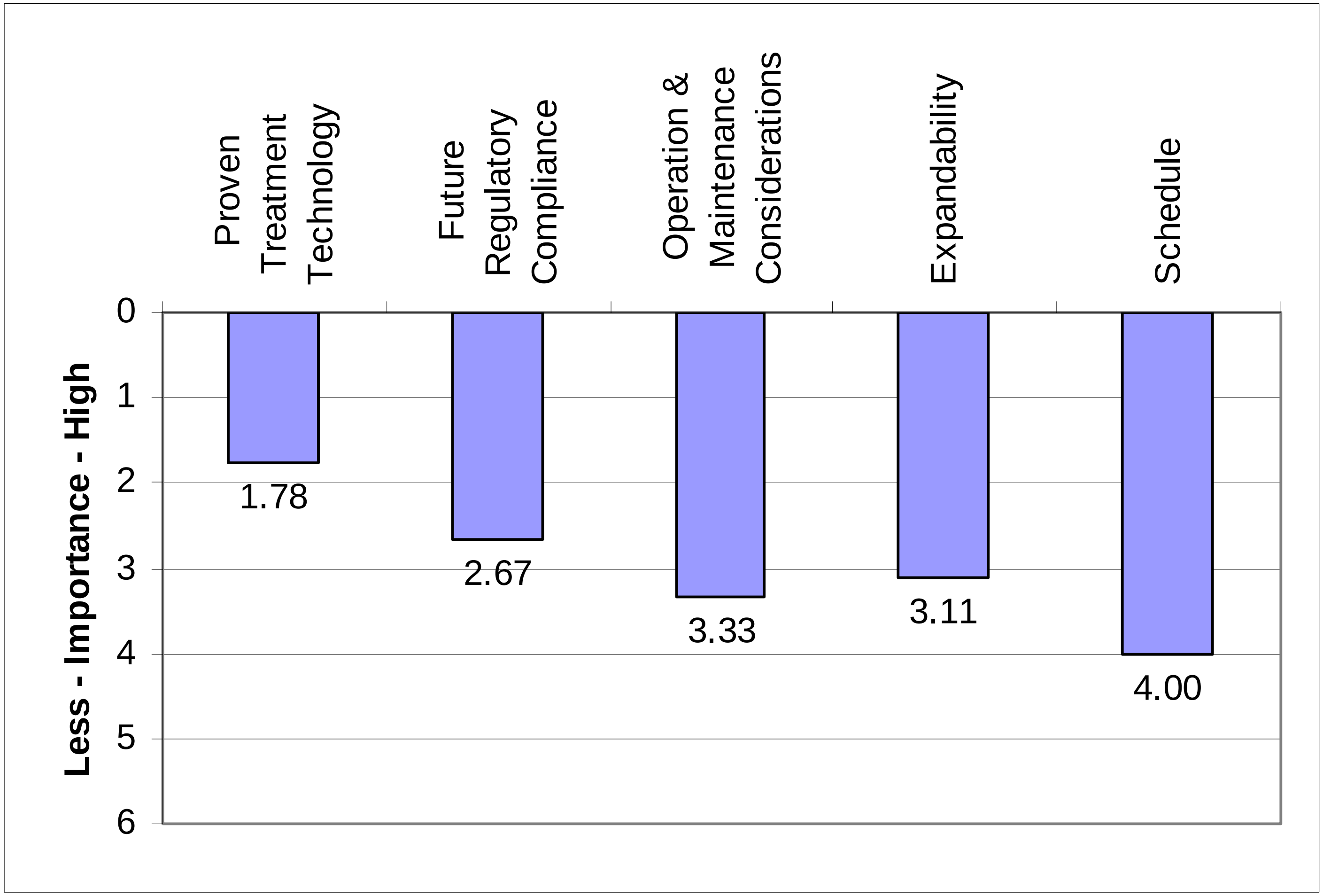
Technology Sub-criteria - Land Consultant



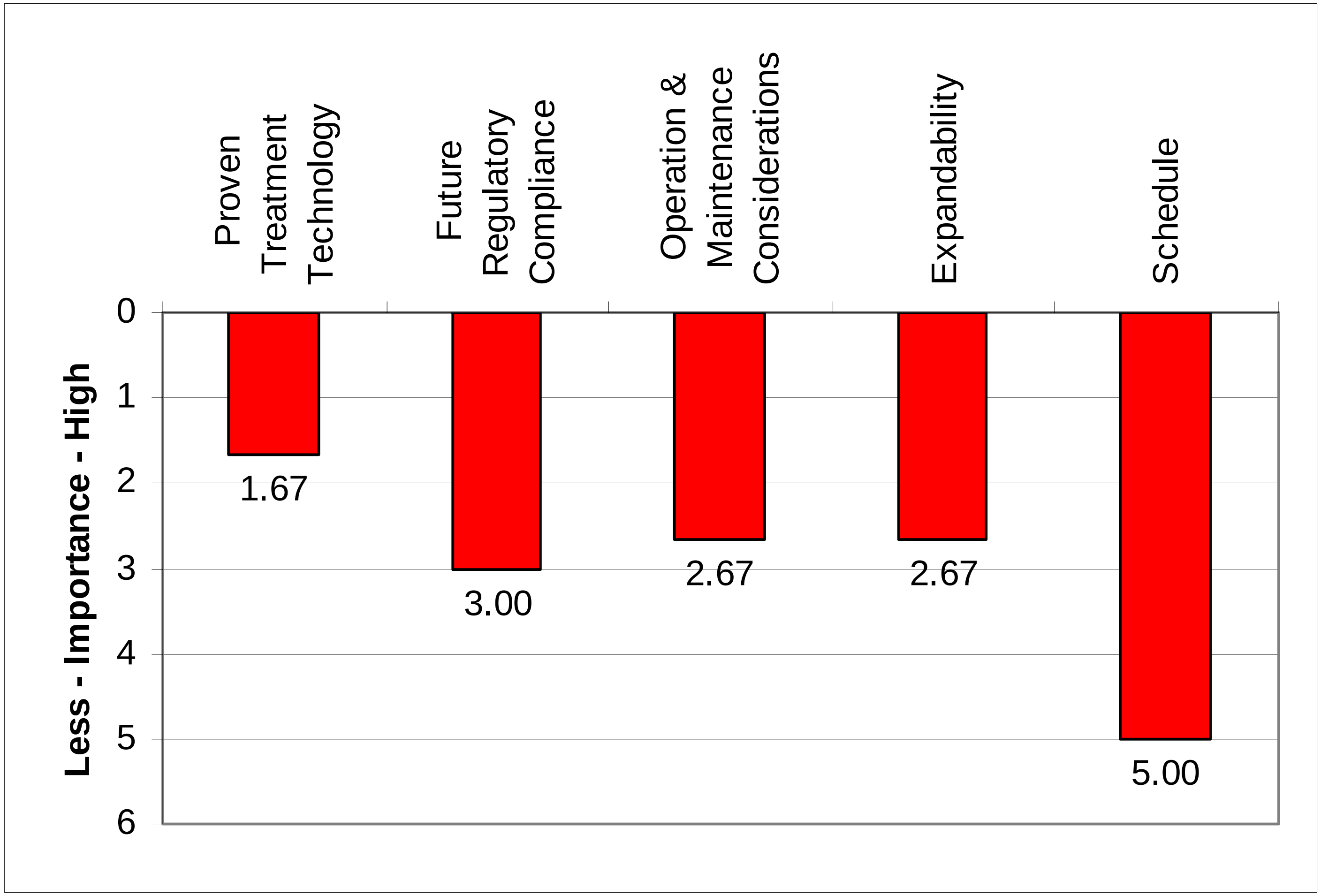
Technology Sub-criteria - Land
Average: PAC/Staff



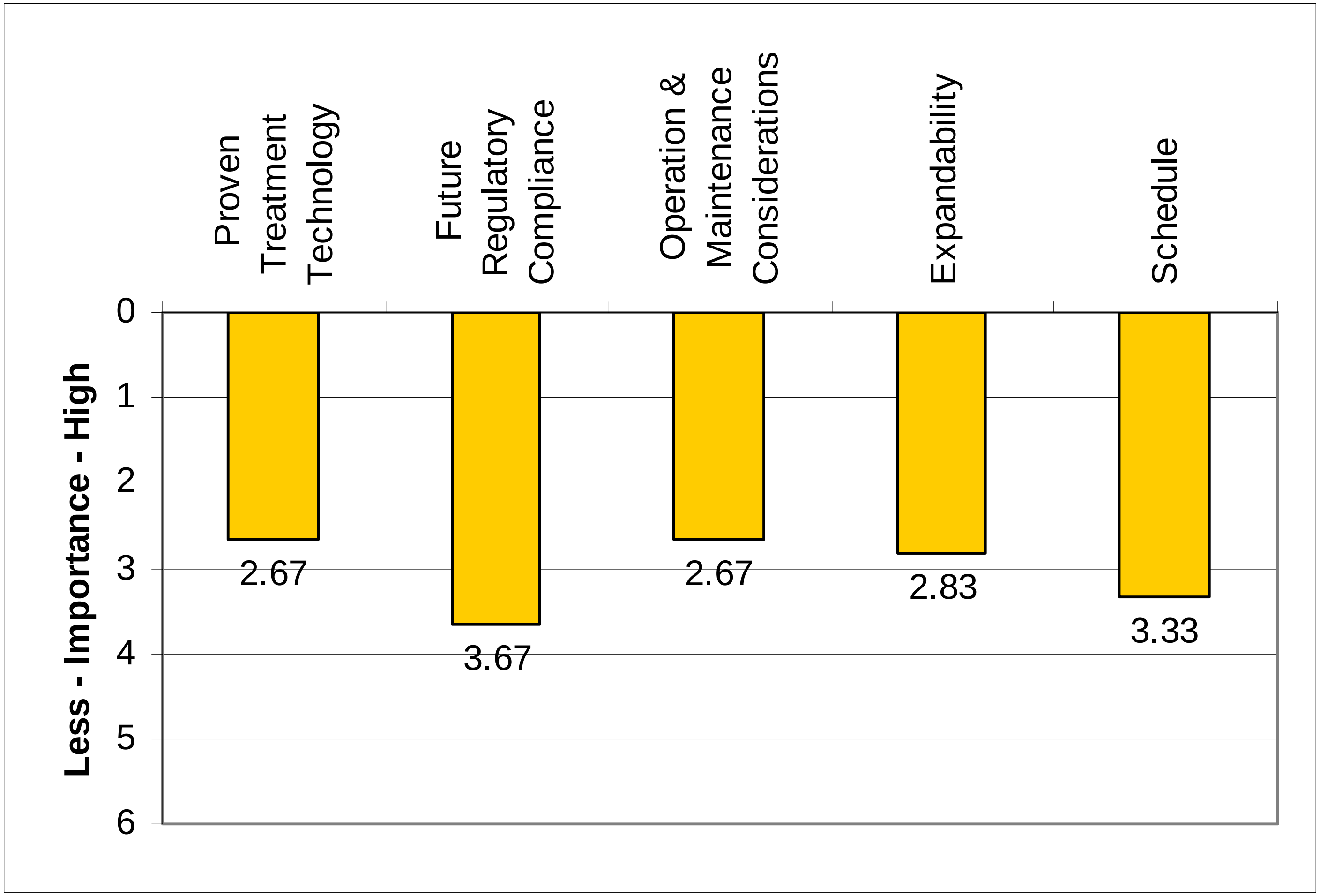
Technology Sub-criteria - Process PAC



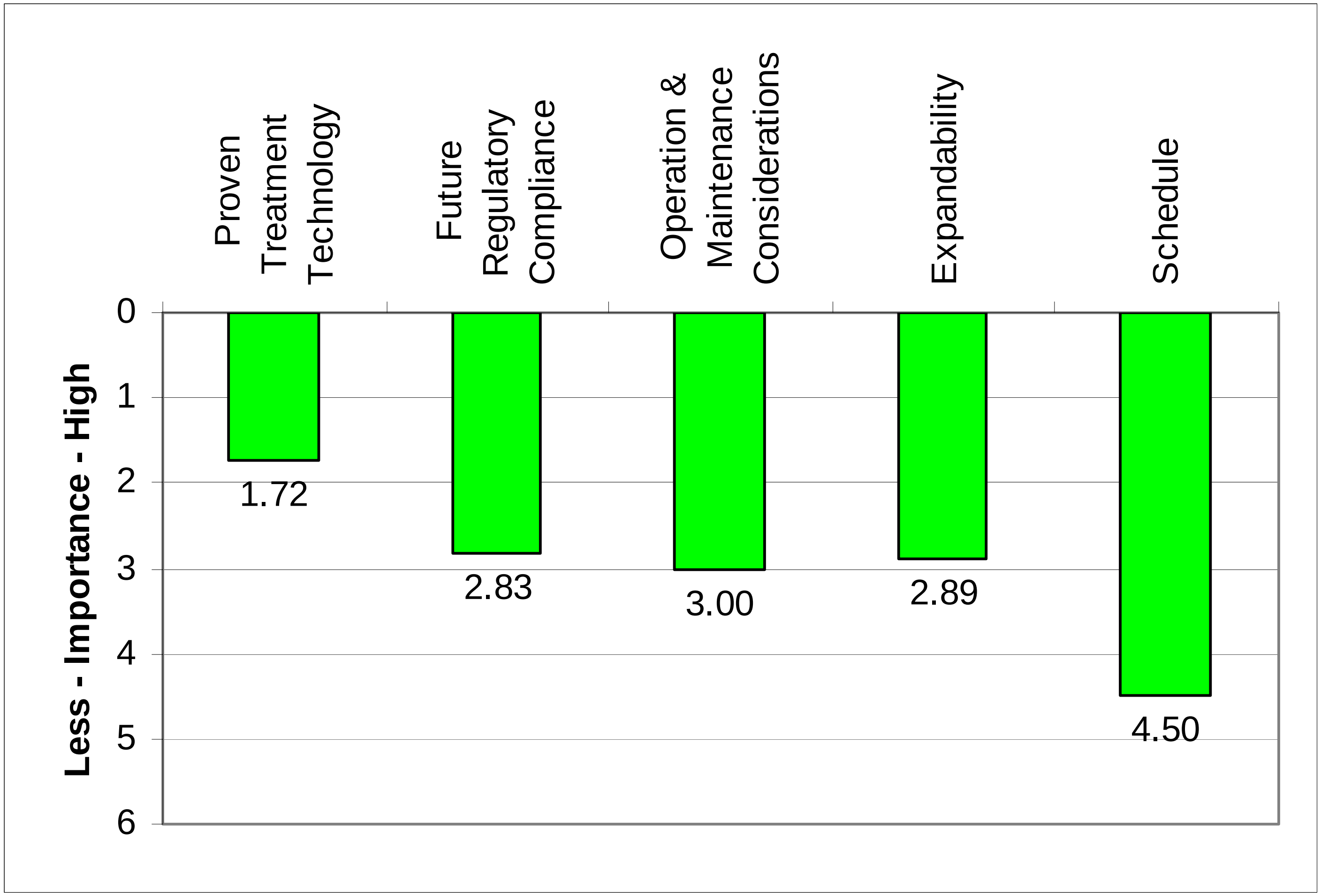
Technology Sub-criteria - Process Staff



Technology Sub-criteria - Process Consultant



Technology Sub-criteria - Process Average: PAC/Staff



Other Criteria to Consider

- Alternative energy sources – wind or solar
- Aesthetics of sludge storage
- Opportunities for wastewater reuse and biosolids recycling
- Opportunity for public education
- Integration with future research to partner with local academic communities
- Biodiversity impacts

Other Criteria to Consider

- Vulnerability to natural/human disasters
- Expandability without creating future environmental hazards
- Bring system on-line incrementally
- Proven technology should not be driving factor
- Strong "sense of place" for homeplaces in area
- Energy consumption, efficiency, incorporation of symbiotic technologies

Other Criteria to Consider

- Community use opportunities
- Enhancement of surrounding environment
- School boundary locations
- Community safety
- Traffic control

Public Meeting No. 1 Questionnaire Results

Wakarusa WRF

Public Meeting #1: November 3, 2005
Community Survey Results

1. Wastewater treatment plants treat collected wastewater while reclamation facilities treat collected wastewater and provide a beneficial reuse of a portion of the waste products. Reuse of waste products can translate into community amenities such as wetlands and ponds. In additional, a buffer area is required around the plant and can include walking trails, green space, or other features.
   a. Of these amenities, which two (2) do you prefer?

i.	Wetlands	**9 Responses**
ii.	Ponds	**1 Response**
iii.	Walking/bike trails	**8 Responses**
iv.	Green space	**10 Responses**

   v. Do you have any additional suggestions?
   - **Public uses of the buffer will depend on odor control. The finest amenities that you can build will not be used if the odor keeps people away.**
   - **Demonstration digester similar to the one at Audubon's Corkscrew Sanctuary in the FL Everglades. Port Aransas, Texas wetlands are a great place to go birding.**
   - **Gray water lines.**
   - **Wild life habitat, accessible to public but only if this does not increase cost.**
   - **Walking trails through wetlands are great if we're not seeing and smelling a treatment plant.**
   - **Golf course.**

Review Decision Hierarchy

Group Breakout

- Community
  - Lisa Patterson/Patti Banks (liaisons)
  - Mike Amyx
  - Michael Campbell
  - Warren Corman
  - Carrie Lindsey
  - Ross Marshall
  - Terry Riordan
  - Debbie Van Saun

Group Breakout

- Environment
  - Jeanette Klamm/Page Surbaugh (liaisons)
  - Tom Bracciano
  - Laura Calwell
  - John Craft
  - Charles Jones
  - Allison Reber
  - Mike Rundle
  - Lavern Squier

Group Breakout

- Technical
  - Mark Hegeman/Dave Wagner/John Keller (liaisons)
  - Michael Almon
  - Michael Caron
  - Philip Ciesielski
  - Bobbie Flory
  - Rod Geisler
  - Roger Pine
  - Mary Lynn Stuart

Wakarusa Water Reclamation Facility
PAC Workshop No. 1

Open Discussion/Feedback

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Next Meeting

January 10, 2006

4:30 to 7:30 pm

WWTP Conference Room??

MEETING MINUTES

Project: Wakarusa WRF
Date: **November 15, 2005**

Wakarusa WRF Public Advisory Committee (PAC) Workshop #1

Attendance:

Representatives from the Public Advisory Committee, City Staff, and Consultant Team were in attendance at the meeting held November 15, 2005 at the Eight Street Wastewater Treatment Plant from from 4:30 to 6:30 PM.

Public Advisory Committee:

- Mary Lynn Stewart (Lawrence Preservation Alliance)
- Lavern Squier (Lawrence Chamber)
- Terry Riordan (Planning Commission)
- Laura Calwell (Kansas Riverkeeper, Friends of the Kaw)
- Tom Bracciano (USD 497)
- Mike Campbell (Sierra Club)
- Michael Caron (Save the Wetlands, Inc.)
- Bobbie Flory (Lawrence Home Builders Association)
- Warren Corman (University of Kansas)
- Rod Geisler (KDHE)
- Mike Amyx (City Commissioner)

City Staff:

- Mike Wildgen (City Manger)
- Lisa Patterson (Communication Manger)
- Brad Ellis (Planning Department)

Consultant Team:

- Patti Banks and Patty Gentrup (Patti Banks Associates)
- Mike Orth, Page Surbaugh, and John Keller (Black & Veatch Corporation)
- Joe Caldwell (Bartlett & West)

Meeting Objectives:

- Patti Banks (Patti Banks Associates) opened the meeting and summarized the day's agenda and meeting objectives as listed below.
  - Review PAC Questions and Responses
  - Review Public Meeting Number 1 and Questionnaire Reponses
  - Review Evaluation Criteria

PAC Questions & Responses from Introductory Meeting:

Review Questions and Responses

- Mike Orth (Black & Veatch Corporation) distributed a handout containing the answers to questions that the Committee had during the October 26th introductory meeting. (See attached)

Overview of Recent Haskell Meeting:

- John Keller (Black & Veatch Corporation) explained that he attended the Haskell meeting. He talked about another project where a City in Arizona proposed to use treated effluent from a wastewater treatment plant to make snow and then distribute it on Native American holy land. This was not well received. Keller drew parallels between this project and what may be the reaction if an alternative is explored to augment the Haskell Wetlands.

Review Stakeholder Summary Report:

Review Stakeholder Interview Findings

- Patty Gentrup (a subcontractor to Patti Banks Associates) gave an overview of the Wakarusa WRF Stakeholder Interview Process. She noted that 24 interviews were completed over a 2.5 week period, primarily at City Hall and that 35 people had participated in the interviews. Participants included elected officials, property owners, business owners, neighborhood representatives, environmental groups, higher education representatives, and City Staff. The respondents were asked a series of questions that included issues to consider in choosing a site, possible amenities at the location, wastewater treatment processes, the wastewater rate structure, growth, and the need for the new facility to support that growth. Gentrup summarized the results of the interviews as follows:

  - **Project Awareness**
    - ✓ Each of the interview participants was aware of the recommendation for a second wastewater treatment facility.

  - **Considerations in determining viable sites**
    - ✓ Environmental issues were the predominant concerns voiced by interviewees. The three environmental issues primarily addressed were to avoid the Baker Wetlands; avoid historic areas such as the California/Oregon Trail and Blanton's Crossing; and just generally mitigate any negative affects the facility could have on the environment, primarily the Wakarusa River.
    - ✓ Odor was the second most common issue of concern. Respondents recognized that a wastewater treatment facility may be surrounded by a noxious odor. In recognition of that, respondents urged that the facility not be placed in such a location that prevailing winds would prevent the odor from permeating the Lawrence community.
    - ✓ A concern for aesthetics was also mentioned. Respondents want to ensure that the plant fits with the environment and is pleasing to the eye.
    - ✓ Finally, the size of the site was of interest. Some respondents believe that enough land should be purchased to allow flexibility in the future. Others believe that a small site and associated design should be pursued.

  - ✓ Respondents said that these issues need to be addressed in order for the facility to be as acceptable to the general public as possible. They recognize that in and around Lawrence, there is a very active group concerned about the environment. As well, the siting and construction of the plant will have an obvious affect on growth. Taking these issues into consideration will allow that affect to be a positive one both for current and future residents.

- **Amenities**
  - ✓ There has been some general discussion regarding amenities that could be within the buffer surrounding the water reclamation facility.
  - ✓ Open space and bike/hike and natural trails were by far the most mentioned amenities. Many respondents also thought the facility could provide educational opportunities for students from pre-school age through college. Other suggestions included Frisbee golf, an arboretum, a neighborhood park, a dog park, and sports fields. Some respondents did voice concern about the wisdom of encouraging the general public to visit the area given the facility should be very secure.
  - ✓ If amenities are included in the project scope, the highest level of odor control should be implemented to avoid the public's aversion to utilizing the facilities constructed due to odors.
  - ✓ The majority of the interviewees were willing to pay more in wastewater rates to fund the construction of the selected amenities.

- **Wastewater Treatment Process**
  - ✓ The only group of respondents that considered themselves knowledgeable about wastewater treatment processes was City employees. The other interviewees said they were vaguely familiar with processes and techniques.
  - ✓ Several mentioned a desire to use created wetlands in the process, but recognized that the Kansas environment and the capacity necessary at the facility were not conducive to using wetlands as a treatment process. Some respondents desire a treatment process that required as little land as possible; still others said it was the job of the engineering consultants to determine the appropriate process.

- **Wastewater Rate Structure**
  - ✓ Interviewees were asked about the new wastewater rate structure put into place at the beginning of 2005. While the majority of the participants were aware that there had been changes in the rate structure, very few knew the details of the changes. Nonetheless, many voiced concern about the affect rates had on average homeowners and some were concerned about the affect they had on large water users. Lastly, some respondents believe the City should annually raise rates at lower levels and should consider larger sewer connection fees for new connections for growth to fund more of the infrastructure expansion.

- **Growth Issues**
  - ✓ No one, to a person, was surprised that the City of Lawrence has been growing and might reach a population of 100,000 before 2011. Reasons for their awareness of this growth ranged from understanding that Lawrence's quality of life draws new residents; that the signs of growth are obvious in the new developments around town; and that many multi-family developments have been approved. Many respondents did indicate that what surprised them about this recent community conversation is that the growth apparently came as a surprise to City officials. Those sentiments were followed with suggestions that the city needs to better plan for its growth--in analyzing applications and the affect development has on

existing infrastructure and through the construction of new infrastructure before it is needed, "to get ahead of the curve."

- ✓ The final issue interviewees were asked to comment on was whether the city should impose a moratorium on development if additional treatment capacity could not be built. And while not one person was surprised by Lawrence's growth, not one person believed that a moratorium on development would be good for the City in the long run. Respondents believe the City should pursue construction of the water reclamation facility and do what it can to reduce the amount of time necessary for the facility to be operational.

Review Criteria Questionnaire Results:

<u>Review PAC, Staff, and Consultant Ratings</u>

- Orth described the primary criteria for site selection according to percentages allotted for community, environment, and technology from the perspectives of the Public Advisory Committee (PAC), City Staff, and Consultant Team which resulted from completion of the questionnaire provided to the team. The average of the PAC and staff responses are included below.
  - **Average: PAC and Staff**
    - ✓ Community 17%
    - ✓ Environment 45%
    - ✓ Technology 38%

- Orth outlined the sub-criteria from the perspectives of the PAC, City Staff, and Consultant Team according to the survey results available prior to the meeting. The average between the PAC and staff of each sub-criterion is included below. The scale for each group is from 1 to the number of items in each sub-criteria and the lower score is indicative of a higher importance.
  - **Community Sub-Criteria: Average PAC and Staff**
    - ✓ Aesthetics 4.07
    - ✓ Noise Control 5.23
    - ✓ Odor Control 3.12 (most important)
    - ✓ Prevailing Winds 4.38
    - ✓ Lighting Control 5.87
    - ✓ Traffic Considerations 4.95
    - ✓ Fit with Current Land Uses 4.48
    - ✓ Fit with Future Land Uses 3.85
  - **Environment Sub-Criteria: Average PAC and Staff**
    - ✓ Stream Impacts 1.15 (most important)
    - ✓ Rare or Endangered Species Impacts 3.15
    - ✓ Archeological/Historic Evidence 3.22
    - ✓ Existing Wetlands Impacts 2.48
  - **Technology Sub-Criteria (Land): Average PAC and Staff**
    - ✓ Number of Landowners 4.60
    - ✓ Displacement of Housing 4.03
    - ✓ Potential Services Acreage by Gravity 1.73 (most important)
    - ✓ Usability/Shape 2.52
    - ✓ Maximizes Use of Existing Infrastructure 4.02
    - ✓ Interference with Kansas River WWTP 4.10

- **Technology Sub-Criteria (Process): Average PAC and Staff**

✓ Proven Treatment Technology	1.72 (most important)
✓ Future Regulatory Compliance	2.83
✓ Operation & Maintenance Considerations	3.00
✓ Expandability	2.89
✓ Schedule	4.50

- Orth provided a summary of the other criteria submitted by the PAC/Staff/Consultant team that they thought should also be considered, including:
  - Alternative energy sources – wind or solar
  - Aesthetics of sludge storage
  - Opportunities for wastewater refuse and biosolids recycling
  - Opportunity for public education
  - Integration with future research to partner with local academic communities
  - Biodiversity impacts
  - Vulnerability to natural/human disasters
  - Expandability without creating future environmental hazards
  - Bring system on-line incrementally
  - Proven technology should not be the driving factor
  - Strong "sense of place" for home places in the area
  - Energy consumption, efficiency, and incorporation of symbiotic technologies
  - Community use opportunities
  - Enhancement of surrounding environment
  - School boundary locations
  - Community safety
  - Traffic control

Public Meeting No. 1 Questionnaire Results:

Review Responses

- Banks explained that meeting participants were asked to complete a survey at the November 3rd public meeting that contained questions related to the amenities preferred around the proposed water reclamation facility; concerns that would affect public acceptability and the appearance of the proposed facility; and, whether the community is willing to pay more in wastewater rates to provide amenities that draw the people to the facility and require additional odor control measures. Survey results were as follows:
  - Green space and wetlands were the top two most preferred amenities for the proposed plant. Ponds were least preferred. Additional suggestions included:
    - ✓ Odor control
    - ✓ Demonstration digester similar to the one at Audubon's Corkscrew Sanctuary in the Florida Everglades
  - Residents were most concerned about the control of odors, aesthetics/architectural character, and the impact of truck traffic.
  - Residents were willing 3:1 to pay more in wastewater rates to provide amenities that draw the public to the facility and require additional odor control measures
  - Other community concerns included:

- ✓ Importance of the facility being invisible and the smell being undetectable
- ✓ Energy efficiency
- ✓ Green design

▪ Banks reviewed the survey results in relation to the PAC and Staff Criteria as well as the responses gathered from the stakeholder interviews. The outstanding issue from all sources was odor control. This was found to be consistent with the model results thus far.

Review Decision Hierarchy:

Review Criterion Decision Plus Model

▪ Orth reviewed the model that was build to evaluate the sites with the Committee. He also reviewed the following and suggested additions to the criteria. The final decision related to each is shown in **bold**. Orth said that the Committee should consider the model as they discuss the evaluation criterion and the Committee commented that:

- o Alternative energy sources – wind or solar – **no global impact on space**
- o Aesthetics of sludge storage – **already covered**
- o Opportunities for wastewater re-use and included in expandability
  - ✓ Biosolids recycling – **will be included for all alternatives**
  - ✓ Is not a differentiator
- o Opportunity for public education
  - ✓ Integration with future search to partner with local academic communities
- o Biodiversity impacts – **will be included as a sub-criteria**
  - ✓ Tied to education
  - ✓ Location is increasing the possibility of biodiversity
    - Can be a differentiator
- o Vulnerability to natural/human disaster – **not a differentiator**
  - ✓ Throw this into operations and maintenance
  - ✓ Don't eliminate the potential for multiple, dispersed sites –**security is better at one site & the potential to obtain land is better now than in the future**
- o Expanding without creating future environmental hazards
- o Why is it easier to buy one big site instead of several smaller sites
- o Hyper wetland
- o Bring on incrementally – **phasing will be evaluated in the future; intent is to buy sufficient land to accommodate growth in the watersheds outside the Urban Growth Area.**
- o Strong sense of place for home places in area – **there should be some consideration for those that have had land for generations – be sure to cover local stories under historical considerations**
- o Energy consumption, efficiency, incorporation of symbolic technologies – **a design issue; not a differentiator staff would put in operation and maintenance**
- o Community use opportunities **– not a differentiator between alternatives**
- o Enhancement of surrounding environment**– not a differentiator between alternatives**
- o
- o School boundary locations – **the issue of Lawrence tax dollars supporting growth in other school districts should be considered**
- o Community safety**– not a differentiator between alternatives**

- o Traffic control**– not a differentiator between alternatives**

- o Weights of issues makes sense

These suggestions were reviewed to determine if they were not already represented by some other sub-criteria already included within the evaluation matrix. The topics were also reviewed to see if they represented a difference between the sites or not. For instance, Community use opportunities would be common at all sites and would dictate the area needed, but this use, if strongly desired, would be common to all sites and wouldn't reflect a difference.

Upon, completion of this effort, the PAC/Staff/Consultant Questionnaire was revised by Black & Veatch and sent back out to the group for revision of their original responses to update the evaluation matrix.

Group Breakout:

- The Committee, City Staff, and consultant team were broken into groups to discuss the primary criteria (community, environment, and technology). Comments included:

  <u>Community</u>

  - Are we understanding traffic?
    - ✓ Heavy, odorous in spring and fall but frequency is very limited
    - ✓ Four days twice a year
    - ✓ Felt the existing ranking was ok
  - Siting for the plant vs. what the plant looks like with regard to aesthetics
  - Need to find out what side of the river is the trail planned for
  - Would like a tour – the availability of a bus will be checked

  <u>Environmental</u>

  - Schedule should be considered as a primary criteria
  - Consider weight of "stream impact" in comparison with other sub criteria
  - Improve definition of "stream impact"

  <u>Technology</u>

  - Schedule should also be considered as primary criteria.
  - In lieu of splitting criteria weight 50/50 for process and land, both should be considered primary criteria.
  - Criteria results for PAC and City staff are very similar except for "usability." Improve definition of "usability."

Next Meeting:

- The next PAC meeting will be held January 18, 2006 from 3:00 p.m. to 7:30 p.m. in the Commission Chambers, City Hall. The first hour of the meeting will be a public wetlands seminar presented by Dr. Robert Kadlec. Interested PAC members are encouraged to participate in the seminar.
- The next public meeting will be January 23, 2005 at South Junior High from 7 to 8:30 pm.

Agenda
Workshop No. 2
Wakarusa Water Reclamation Facility

Date: January 18, 2006
Time: 4:00 to 7:00 pm
Location: Commission Chambers, City Hall

Meeting Objectives (PBA) — **5 minutes**
- Review wetlands presentation
- Review updated questionnaire results
- Rank areas with relation to criteria
- Review proposed content of Public Meeting #2

Wetlands Discussion (Dr. Kadlec) — **15 minutes**

Review Updated Criteria Questionnaire Results (MGO) — **5 minutes**
- Review blended PAC and Staff ratings

Define Alternatives (MGO) — **10 minutes**
- Ultimate build-out capacity – 50 MGD
- Review small, medium, large technology footprint alternatives

Review Ranking Process (MGO) — **5 minutes**
- Example scoring

Group Breakout (All) — **75 minutes**
- Breakout into assigned groups
- Review preliminary rankings for assigned areas according to the criteria
- Record topics for additional discussion with full group

Break/Dinner (All) — **10 minutes**

Open Discussion of Group Results (All) — **45 minutes**

Information Sharing (PBA) — **5 minutes**

Public Meeting #2 Scheduled (PBA) — **5 minutes**
- January 23, 2006, 7:00 to 8:30 pm, South Junior High School
- Meeting to cover:
  - criteria selection and results
  - results of stakeholder interviews
  - additional criteria suggestions
  - path forward

Next PAC Meeting

- TBD

Wakarusa Water Reclamation Facility
PAC Workshop No. 2

January 18, 2006
4:00 to 7:00 pm

Commission Chambers, City Hall

HNTB

PBA PATTI BANKS ASSOCIATES

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ENERGY WATER INFORMATION GOVERNMENT

BARTLETT & WEST ENGINEERS

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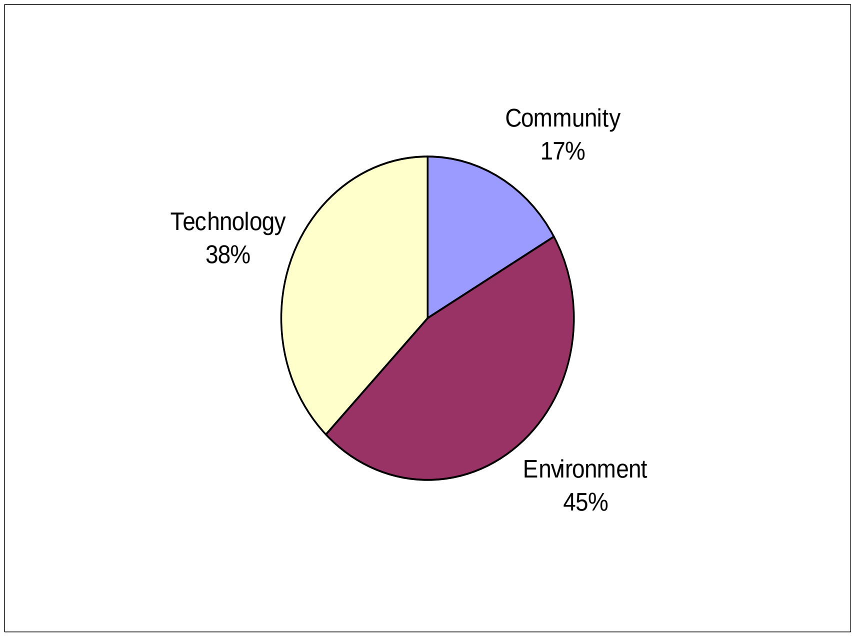
Agenda

- Wetlands Discussion
- Review Updated Criteria Results
- Define Alternatives
- Review Ranking Process
- Group Breakout
- Open Discussion
- Information Sharing
- Public Meeting #2

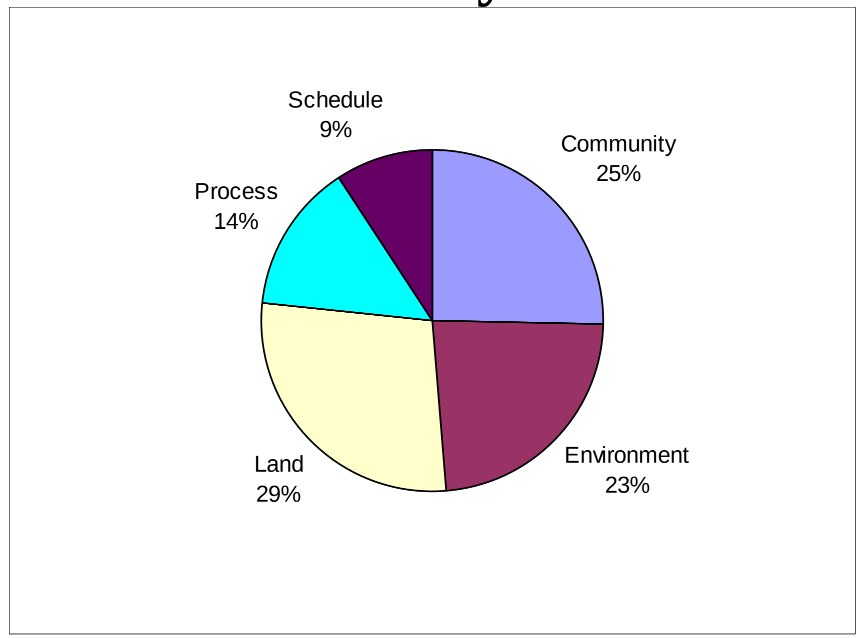
Primary Criteria
Average: PAC/Staff

Survey 1



- Community 17%
- Environment 45%
- Technology 38%

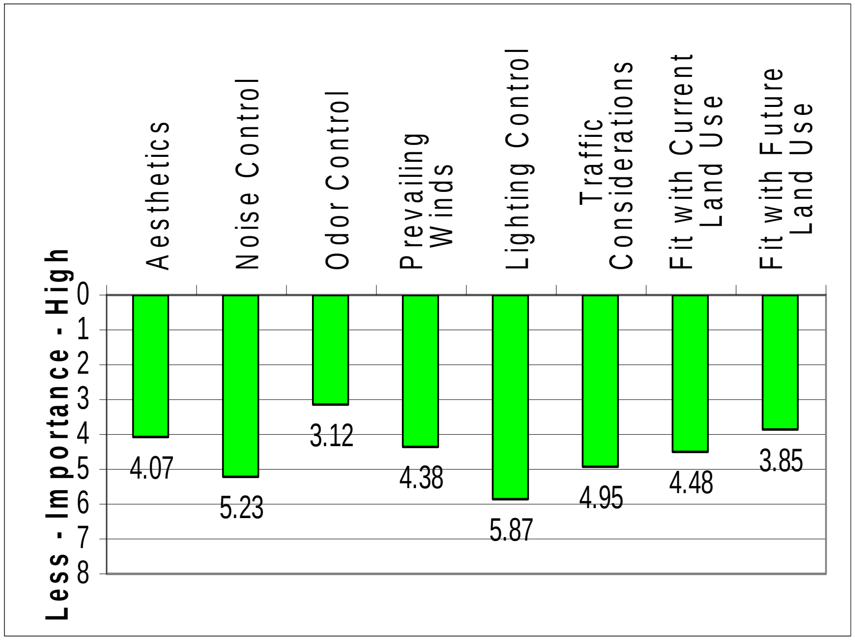
Survey 2



- Community 25%
- Environment 23%
- Land 29%
- Process 14%
- Schedule 9%

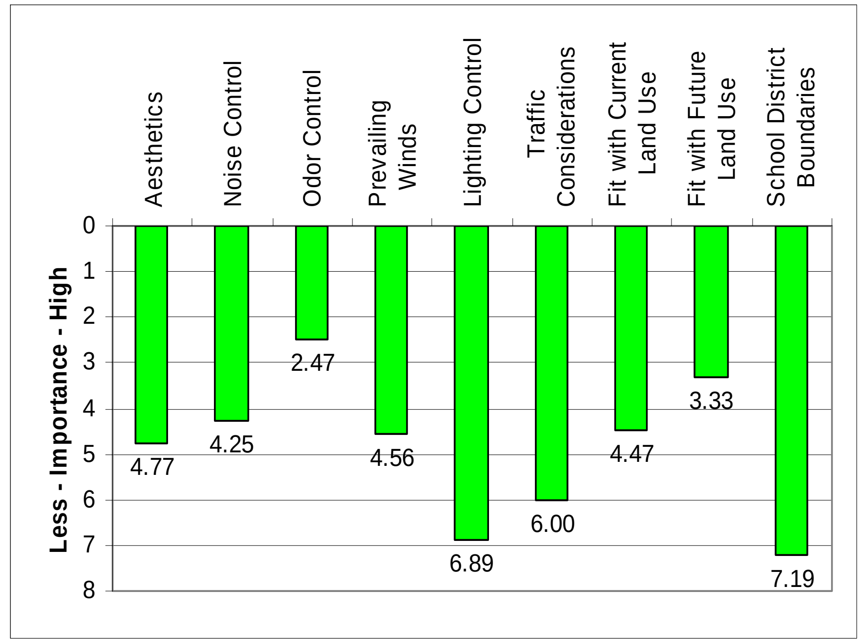
Community Sub-Criteria Average: PAC/Staff

Survey 1



- Odor Control (3.12)
- Fit with Future Land Use (3.85)
- Aesthetics (4.07)
- Prevailing Winds (4.38)

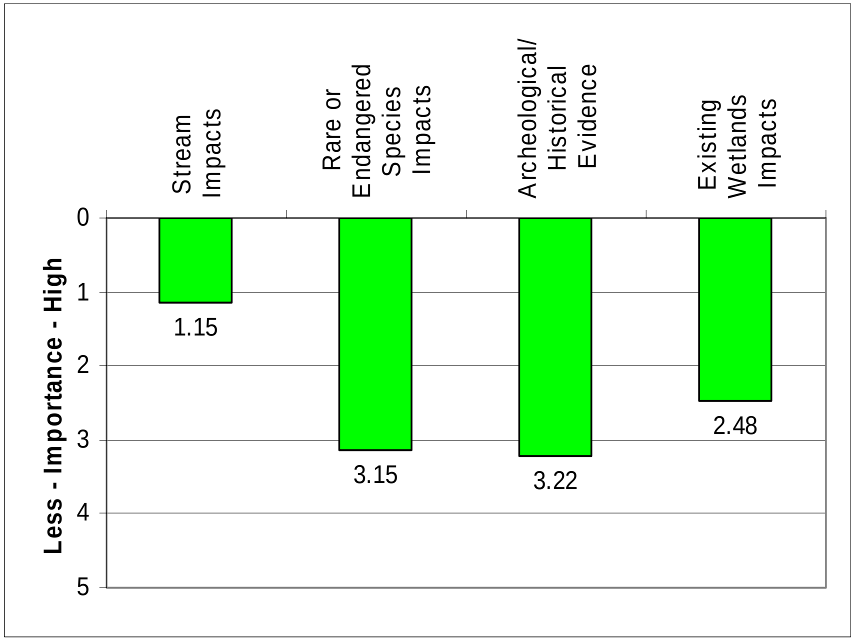
Survey 2



- Odor Control (2.47)
- Fit with Future Land Use (3.33)
- Noise Control (4.25)
- Fit with Current Land Use (4.47)

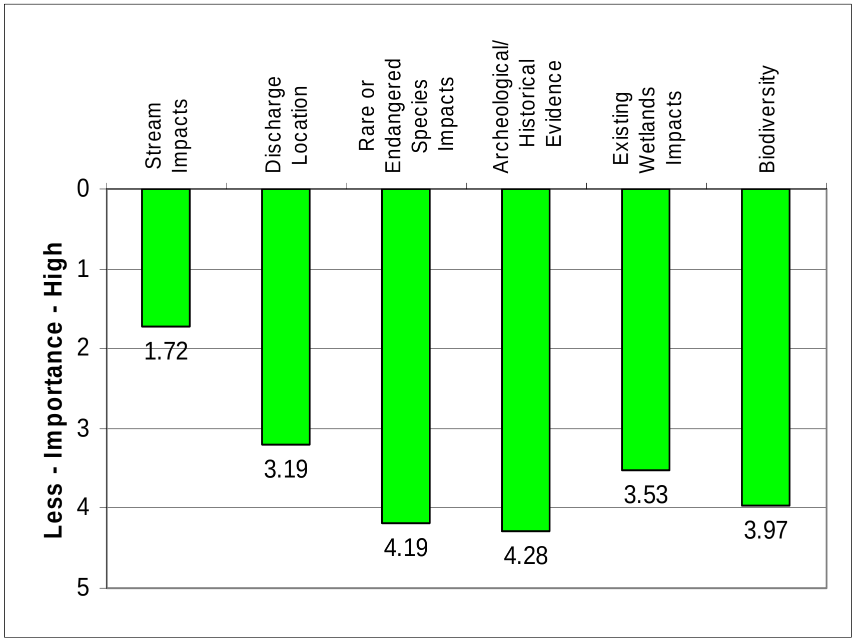
Environment Sub-Criteria Average: PAC/Staff

Survey 1



- Stream Impacts (1.15)
- Existing Wetlands Impacts (2.48)
- Rare or Endangered Species Impacts (3.15)

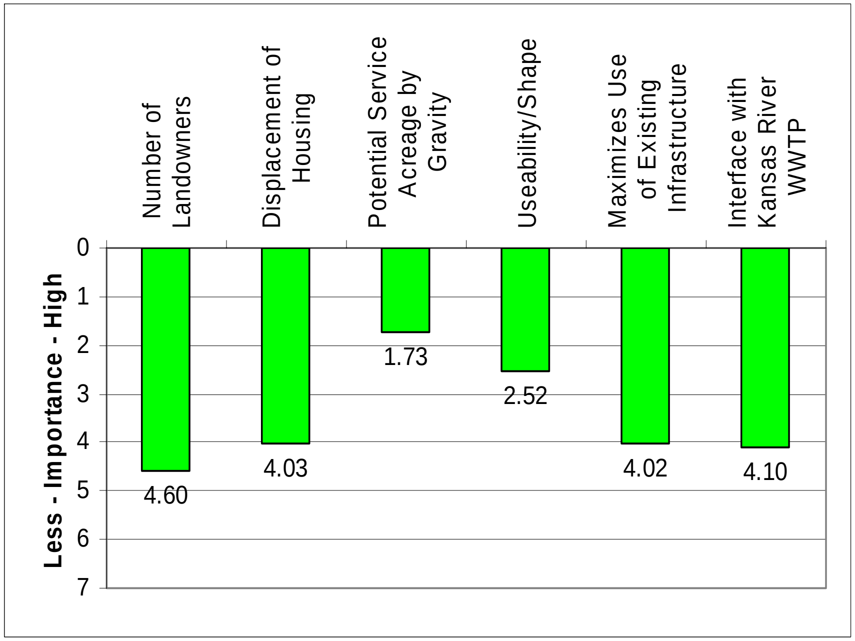
Survey 2



- Stream Impacts (1.72)
- Discharge Location (3.19)
- Existing Wetlands Impacts (3.53)

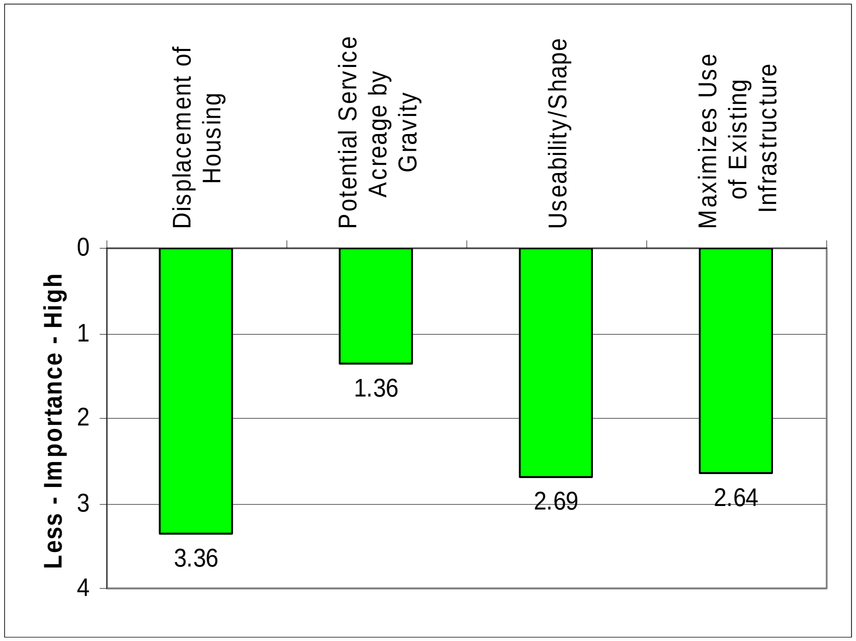
Land Sub-Criteria
Average: PAC/Staff

Survey 1



- Potential Service Area by Gravity (1.73)
- Useability/Shape (2.52)
- Maximize Use of Existing Infrastructure (4.02)
- Displacement of Housing (4.03)

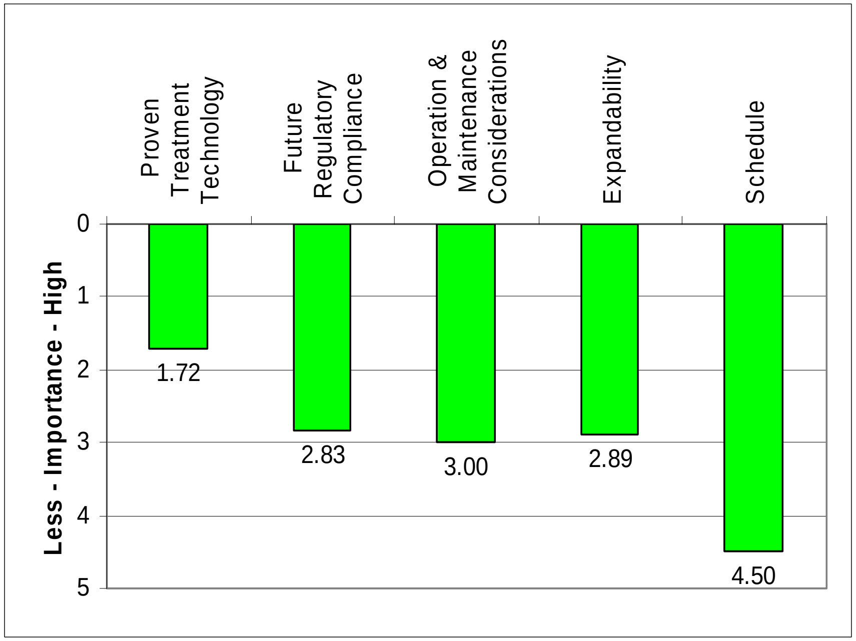
Survey 2



- Potential Service Area by Gravity (1.36)
- Maximize Use of Existing Infrastructure (2.64)
- Useability/Shape (2.69)

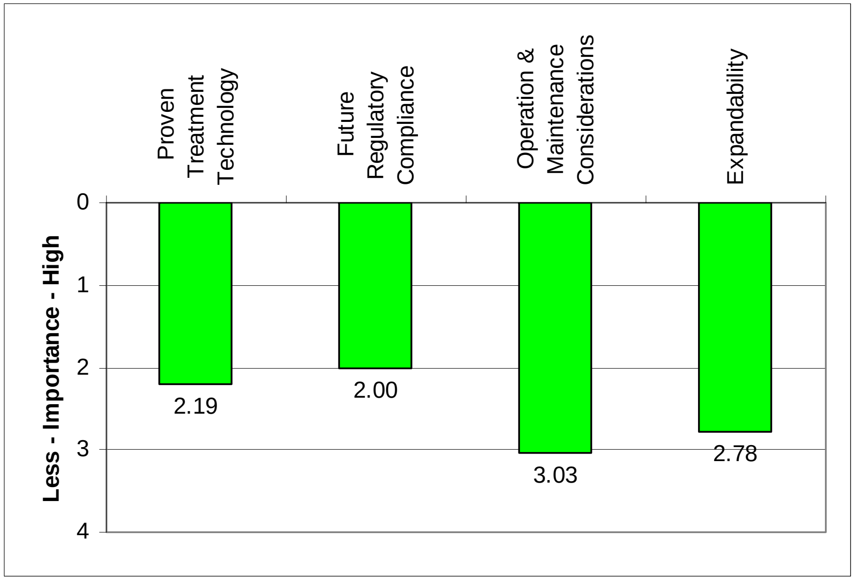
Process Sub-Criteria Average: PAC/Staff

Survey 1



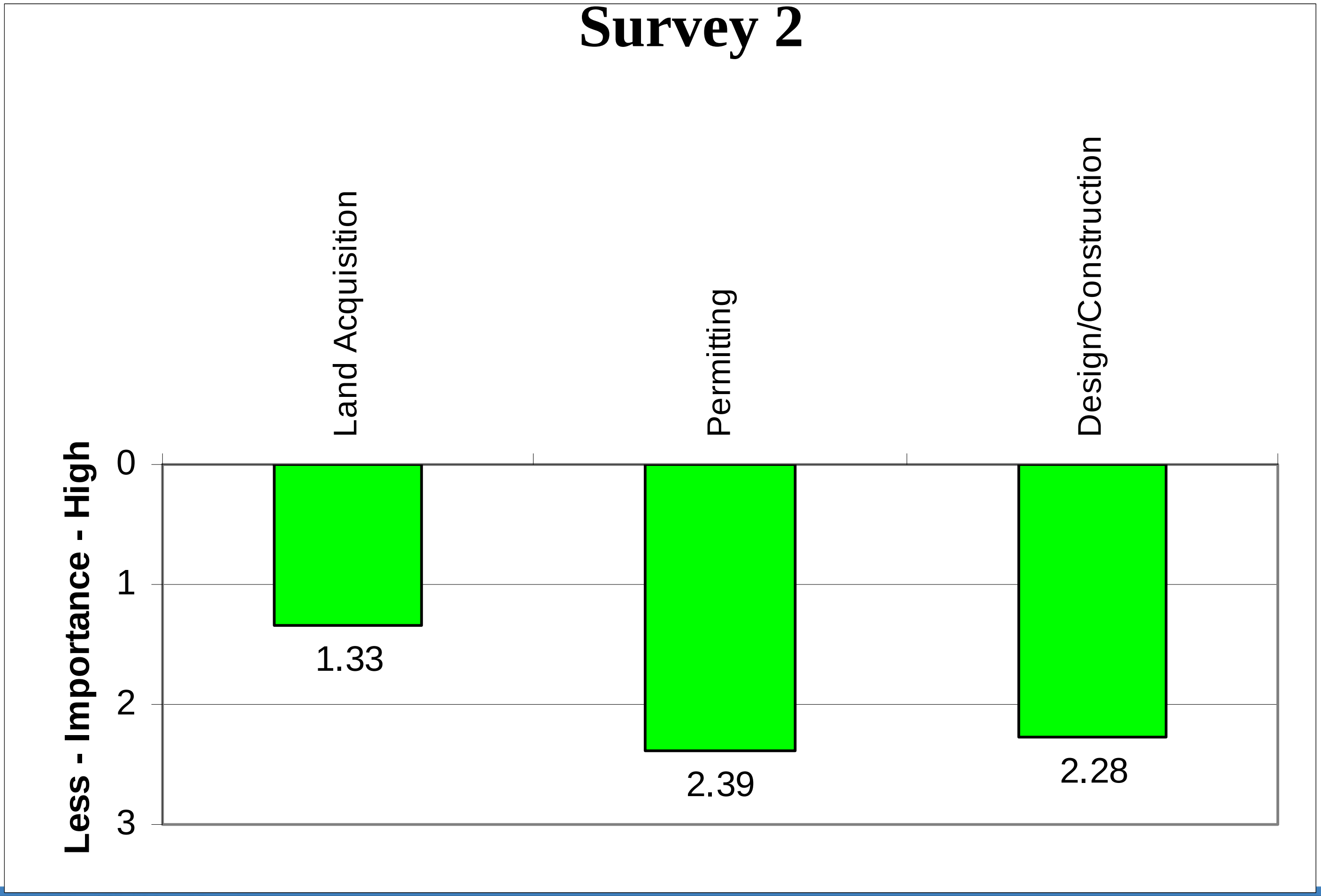
- **Proven Treatment Technology (1.72)**
- **Future Regulatory Compliance (2.83)**
- **Expandability (2.89)**

Survey 2



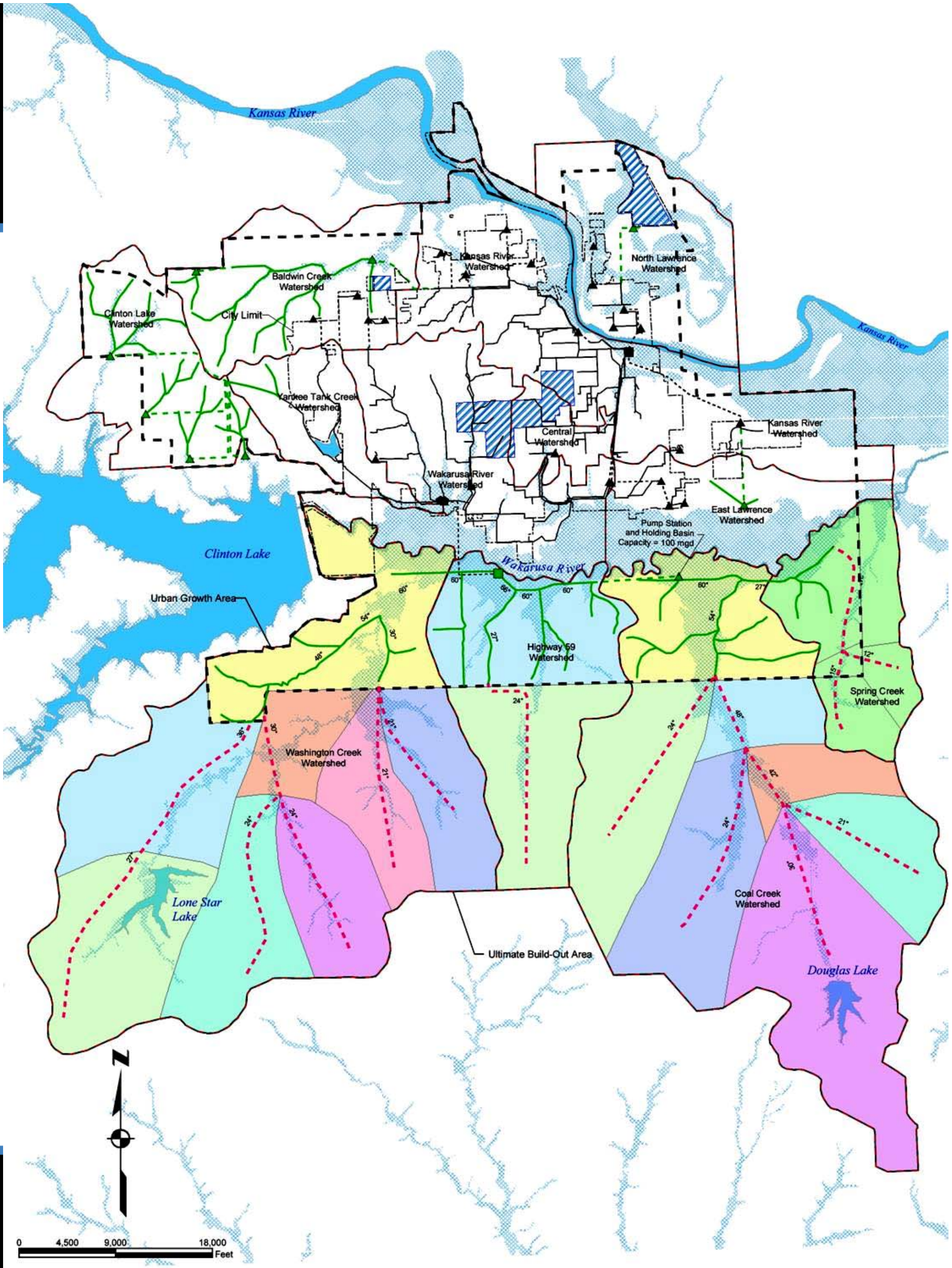
- **Future Regulatory Compliance (2.00)**
- **Proven Treatment Technology (2.19)**
- **Expandability (2.78)**

Schedule Sub-criteria Average: PAC/Staff



Define Alternatives

- Ultimate Build-out Capacity
  - 50 MGD



Define Alternatives

Alternative	Acreage Required*
Small	235
Medium	300
Large	1000

Includes wet-weather treatment, solids management, and buffer.

Group Breakout

- Liaisons for Community
  - Mike Orth
  - Page Surbaugh
  - Lisa Briscoe
- Liaisons for Environment
  - John Keller
  - Cindy Wallis-Lage
  - Patti Banks

Public Meeting #2

- Monday, January 23, 7:00 to 8:30 pm
  South Junior High School
- Topics
  - Results of stakeholder interviews
  - Criteria selection and results
  - Public input on criteria considerations
  - Next steps

Wakarusa Water Reclamation Facility
PAC Workshop No. 2

HNTB

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Wakarusa WRF

MEETING MINUTES

Project: Wakarusa WRF
Date: **January 18, 2006**

Wakarusa WRF Public Advisory Committee (PAC) Workshop #2

Attendance:

Representatives from the Public Advisory Committee, City Staff, and Consultant Team were in attendance at the second PAC workshop held in City Hall, Commission Chambers from 4:00 to 7:00 PM on January 18, 2006.

Public Advisory Committee:

- Mary Lynn Stuart (Lawrence Preservation Alliance)
- Lavern Squier (Lawrence Chamber)
- Laura Calwell (Kansas Riverkeeper, Friends of the Kaw)
- Mike Campbell (Sierra Club)
- Michael Caron (Save the Wetlands, Inc.)
- Bobbie Flory (Lawrence Home Builders Association)
- Warren Corman (University of Kansas)
- Rod Geisler (KDHE)
- Mike Amyx (City Commissioner)
- Michael Almon (Brook Creek Neighborhood)
- Mike Rundle (City Commissioner)
- Roger Pine (Pine family farms / Kansas Senate)
- Charles Hawkins (Haskell Indian Nations University)
- Mike Bowman (Citizen at Large)

City Staff:

- Debbie Van Saun (Assistant City Manager)
- Lisa Patterson (Communication Manger)
- Philip Ciesielski (Utilities Engineer)
- Dan Warner (Planning Department)
- Dave Wagner (Assistant Director, Wastewater)
- Mark Hegeman (WWTP Superintendent)
- Jeanette Klamm (Biosolids Manager)

Consultant Team:

- Patti Banks and Lisa Briscoe (Patti Banks Associates)
- Mike Orth, Page Surbaugh, John Keller, and Cindy Wallis-Lage (Black & Veatch Corporation)
- Joe Caldwell (Bartlett & West)
- John Pasley and Jennifer Johnson (HNTB)
- Dr. Robert Kadlec (Wetlands Management Services)

Introduction and Today's Agenda:

- Patti Banks (Patti Banks Associates) opened the meeting and outlined the meeting's agenda.
  - Review Of Wetlands Presentations
  - Review Of Updated Criteria Questionnaire Results
  - Definition Of Alternatives
  - Review Of Ranking Areas With Relation To Criteria
  - Group Breakout Discussion
  - Information Sharing
  - Review Proposed Contents Of Public Meeting #2

Wetlands Discussion:

- Dr. Robert Kadlec (Professor Emeritus of Chemical Engineering, University of Michigan) led a brief discussion about the afternoon's Wetlands Seminar held in the Commission Chambers from 3:00 - 4:00 PM. The Committee asked him if he had experience in talking with the community about these issues and what had been the community's acceptance of them? Kadlec answered that he was experienced in dealing with community issues and has learned that information exchange must occur in the excess to be successful.

Eco Machine Sub-group Request:

- Mike Orth (Black & Veatch) explained that PAC member Michael Almon has requested that the PAC allow approximately 15 minutes at the beginning of the meeting to allow the Eco Machine subgroup of the PAC time to present its findings.
- Almon stated that he represented the Eco Machine subgroup of the PAC including: himself, Laura Calwell, Michael Campbell, Michael Caron, Carey Maynard-Moody (non-PAC member), and Joyce Wolfe (non-PAC member). Almon outlined the group's issues and requests as follows:
  - That the City Commission review and revise the Consultant contract and the role of the PAC to investigate Eco Machine technology on a decentralized basis.
  - That the City bring professional consultants from John Todd Ecological Design or similar firm to survey and evaluate future needs and provide more specific cost figures suited to the City's particular needs.
- The PAC considered requesting that an additional two to three meetings be added to the scope at the City Commission's discretion to allow adequate time to consider the Eco Machine option in terms of capacity issues, decentralization, criteria in existence for the process, and more.
- The PAC gave a showing of hands to demonstrate a majority agreement among members present interested in pursuing the Eco-Machine sub-group requests. A majority of hands was given and discussion followed. As a result, Commissioners Amyx and Rundle agreed to place the request on the next City Commission agenda, the following week, to give consideration to the Eco Machine subgroup's requests.
- As a part of the overall discussion, Orth recommended that the PAC tour the Missouri Department of Conservation's building in Kansas City, Missouri, to better educate ourselves on this technology.

Review Updated Criteria Questionnaire Results:

- Mike Orth (Black & Veatch Corporation) reviewed results of the blended PAC and Staff primary criteria and sub-criterion with the PAC. Orth referred the PAC to the December 20, 2005 Memorandum which provides a summary of the results from the second version of the Wakarusa criteria questionnaire.

  The primary criteria are weighted as a percent of importance on siting the new facility.

  Primary Criteria
  - **Survey 1:**
    - ✓ Community 17%
    - ✓ Environment 45%
    - ✓ Technology 38%
  - **Survey 2:**
    - ✓ Community 25%
    - ✓ Environment 23%
    - ✓ Land 29%
    - ✓ Process 14%
    - ✓ Schedule 9%

  Orth reminded the group that the sub-criteria are scored with lower numbers being more important.

  Community Sub-Criteria
  - **Survey 1:**
    - ✓ Odor Control 3.12
    - ✓ Fit with Future Land Use 3.85
    - ✓ Aesthetics 4.07
    - ✓ Prevailing Winds 4.38
  - **Survey 2:**
    - ✓ Odor Control 2.47
    - ✓ Fit with Future Land Use 3.33
    - ✓ Noise Control 4.25
    - ✓ Fit with Current Land Use 4.47

  Environment Sub-Criteria
  - **Survey 1:**
    - ✓ Stream Impacts 1.15
    - ✓ Existing Wetlands Impacts 2.48
    - ✓ Rare or Endangered Species Impacts 3.15
  - **Survey 2:**
    - ✓ Stream Impacts 1.72
    - ✓ Existing Wetlands Impacts 3.19
    - ✓ Rare or Endangered Species Impacts 3.53

  Land Sub-Criteria
  - **Survey 1:**
    - ✓ Potential Service Area by Gravity 1.73
    - ✓ Usability/Shape 2.52

- ✓ Maximize Use of Existing Infrastructure 4.02
- ✓ Displacement of Housing 4.03

- o **Survey 2:**
  - ✓ Potential Service Area by Gravity 1.36
  - ✓ Maximize Use of Existing Infrastructure 2.64
  - ✓ Usability/Shape 2.69

Process Sub-Criteria

- o **Survey 1:**
  - ✓ Proven Treatment Technology 1.72
  - ✓ Future Regulatory Compliance 2.83
  - ✓ Expandability 2.89
- o **Survey 2:**
  - ✓ Future Regulatory Compliance 2.00
  - ✓ Proven Treatment Technology 2.19
  - ✓ Expandability 2.78

Schedule Sub-Criteria

- o **Survey:**
  - ✓ Land Acquisition 1.33
  - ✓ Permitting 2.39
  - ✓ Design/Construction 2.28

In summary, the PAC's suggested edits to the primary and secondary criteria further segmented the issues, but the items that were initially important to us in making a decision remained important.

Define Alternatives:

- Orth referred the PAC to the January 12, 2006 Memorandum which outlines the review process to be conducted at today's meeting and described the three major footprint alternatives to be considered; he also referred the PAC to the January 6, 2006 Memorandum-Ultimate Build-Out Acreage.
- Orth said that alternatives should be defined in terms of ultimate build-out acreage. He noted that by using various forecasting methods, a potential treatment capacity ranging from 30 to 115 maximum gallons per day (mgd) could be considered. The 115 mgd projection assumes a mostly commercial/industrial based level of development, which should not be considered because the City's future land use plans for the Urban Growth Area (UGA) do not support these land uses. As a result, reasonable planning estimates support a mix of land uses that would result in an estimate of 30 to 60 mgd. When the more practical projection is considered in conjunction with a 50-year planning period and corresponding population forecasts, the minimum plant capacity that should be considered to acquire property for would be about 50 mgd.
- Based on the 50 mgd estimate, Orth outlined the advantages and disadvantages of small, medium, and large footprint alternatives.

  Small Footprint Alternatives

  - o A membrane bioreactor (MBR) is an example of a small footprint alternative. Small alternatives generally require 235 acres and consist of applying a high-end technology process to accomplish the treatment goals.

✓ **Advantages**
- Less property to acquire due to a smaller footprint
- Potentially improved aesthetics
- High-end technology produces high quality, consistent effluent
- Suitable for remote operation

✓ **Disadvantage**
- Higher capital cost
- Higher operations and maintenance costs
- Energy intensive technology compared to other alternatives
- Reduced availability to handle peak wet weather flows
- Higher level of process controls

Medium Footprint Alternatives

o The City's existing wastewater treatment plant is an example of a medium footprint alternative. Such alternatives typically require 300 acres and are characterized as "conventional" mechanical plants.

✓ **Advantages**
- Improved handling of peak wet weather flows
- Proven treatment technology
- Operational familiarity by staff
- Process flexibility for future expansions
- Lower installed capital costs
- Lower operational costs
- Consistent quality effluent

✓ **Disadvantage**
- Require more space to accommodate the same volume of treatment
- Increased actual or perceived aesthetics concerns due to the dispersed site layout

Large Footprint Alternatives

o Large footprint alternatives tend to require 1,000 acres and consist of medium treatment processes followed by a treatment wetland.

✓ **Advantages**
- Natural solutions
- Provides opportunities for public wetlands treatment education
- Improved handling of peak wet weather flows
- Proven treatment technology
- Operational familiarity by staff
- Potential aesthetic acceptance gained with wetlands

✓ **Disadvantage**
- Large area required relative to degree of treatment
- Reduced performance during colder weather
- Additional maintenance requirements for wetlands
- Public health concerns with mosquitoes, etc.

Review Ranking Process:

- Orth explained that the Committee had been provided with a color aerial map showing the areas to be considered, a preliminary alternative attributes form, and a preliminary rankings scorecard for reference. The attributes form provided a list of the sub-criteria considered, along with an abbreviated comment relating to the considered alternative. The color-coded scorecard illustrated the Consultant Team's up-to-date scoring of all criteria with a one to five ranking, where a score of five/darkest color represents the least impact (best), while one/lightest color demonstrates the highest impact (worst).

Group Breakout:

- The Consultant Team explained that the Committee would be divided into two groups to review the community and environment scoring. Then they would be asked to indicate the areas of concern that they had with the scoring as part of a larger group discussion.

Open Discussion of Group Results:

- Results of the environment and community groups are outlined below.

  Environment Issues

  - **Discharge Location**
    - ✓ Scoring based on perception inappropriate
  - **Rare or Endangered Species**
    - ✓ Need to look at connections as part of the analysis
    - ✓ Thought process that farming equals less disturbance may not be appropriate
    - ✓ Biodiversity
  - **Archeology**
    - ✓ Need to take a larger deduction on larger footprint
    - ✓ Historic significance impacted by context
      - May not be reflected in scoring
  - **Wetlands/Floodplain**
    - ✓ Shouldn't hydric soil areas be scored higher if we are using wetland treatment?
  - **Discharge**
    - ✓ The score for downstream may be too high
      - Effluent from collection system may get into wetlands more rather than less
  - **Rare and Endangered Species**
    - ✓ Any credit for wetland increasing habitat?

  Community Issues: Group A

  - **Aesthetics**
    - ✓ What is the definition of aesthetics? A wetland could be beautiful.
  - **Noise Control**
    - ✓ What are the noise generators?
  - **Odor**
    - ✓ Why do <u>white</u> sites receive the best scores?
    - ✓ This evaluation process is excellent! However, the process is backwards!

- "The Eco Machine" makes this process moot.
- This process is based on a traditional model which does not include criteria or issues associated with the Eco Machine.

- **Prevailing Winds**
  - ✓ Do the number of day's impact criteria?
  - ✓ Will there be more new residents in the south area?
- **Lighting**
  - ✓ Will down lighting be utilized?
- **Traffic**
  - ✓ Why do "blue" sites tend to receive "1" rankings?

Community Issues: Group B

- **Aesthetics**
  - ✓ What is the impact of large green areas? What informs your choice?
  - ✓ Aesthetics makes all the difference in the world. Just look at downtown as an example. Should criteria weight be increased for select issues?
  - ✓ Noted absence of "marketing" – what is the value of impacts?
  - ✓ Location and topography are also factors
- **Land Use**
  - ✓ Planned improvements to Franklin Road will have an impact on the "white" site. Future expanded use of Franklin Road results in prime potential land. Also 1650 Road.
  - ✓ Need draft right-of-way (ROW) alignment for Franklin Road.
- **Lighting Control**
  - ✓ What's the differentiator here? Can there be cost savings?
- **Traffic**
  - ✓ What's the difference between white and yellow?

Public Meeting #2:

- Banks said that the second public meeting would be January 23, 2006 from 7:00 – 8:30 PM at South Junior High School. Topics discussed would include:
  - Results of the stakeholder interviews
  - Criteria for selection and results
  - Public input on criteria considerations
  - Next steps

Next PAC Meeting:

- Orth said the date, time, and location for the next PAC meeting have yet to be determined.

Agenda
Workshop No. 3
Wakarusa Water Reclamation Facility

Date: February 15, 2006
Time: 4:00 to 7:00 pm
Location: Commission Chambers, City Hall

Meeting Objectives (Banks) — **5 minutes**

- Status update on Eco-Machines Subgroup Activity
- Review area rankings from last meeting
- Rank areas with relation to criteria
- Review content of public outreach campaign

Eco-Machine Subgroup Activity (Van Saun) — **15 minutes**

Review Alternatives (Orth) — **5 minutes**

- Ultimate build-out capacity – 50 MGD
- Review small, medium, large technology footprint alternatives

Review Ranking Process (Orth) — **5 minutes**

- Example scoring

Review Community/Environment Rankings (All) — **45 minutes**

- Discuss rankings adjusted based on last PAC Meeting
- Review public input from Public Meeting No. 2

Break/Dinner (All) — **30 minutes**

Determine Land/Process/Schedule Rankings (All) — **45 minutes**

- Rank areas with relation to criteria
- Review public input from Public Meeting No. 2

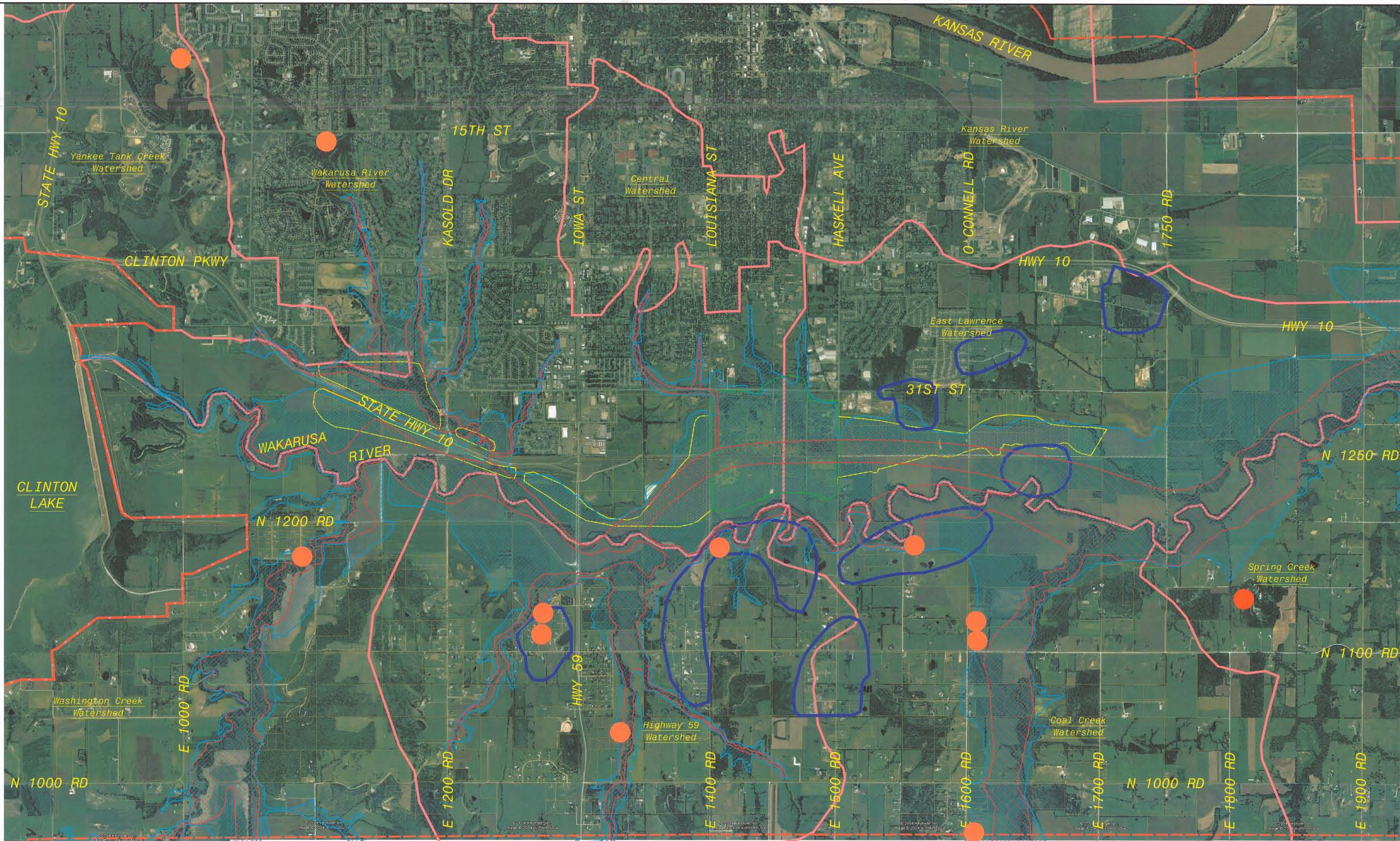
Review Content of Public Outreach Campaign (Banks/Patterson) — **15 minutes**

Information Sharing/Next Steps (Banks) — **10 minutes**

Next PAC Meeting

- Tentative March 1 for Eco-Machine presentation
- Mid-March for Eco-Machine Subcommittee report

Last Revised: 2/13/06



4000' 2000' 0 4000'

APPROX. SCALE IN FEET

LEGEND

APPROX. FLOODPLAIN	PROPERTY LINE
APPROX. FLOODWAY	APPROX. WATERSHED BOUNDARY
APPROX. HYDRIC SOILS	APPROX. URBAN GROWTH AREA
BAKER WETLANDS	POTENTIAL HISTORIC/ CULTURAL RESOURCES

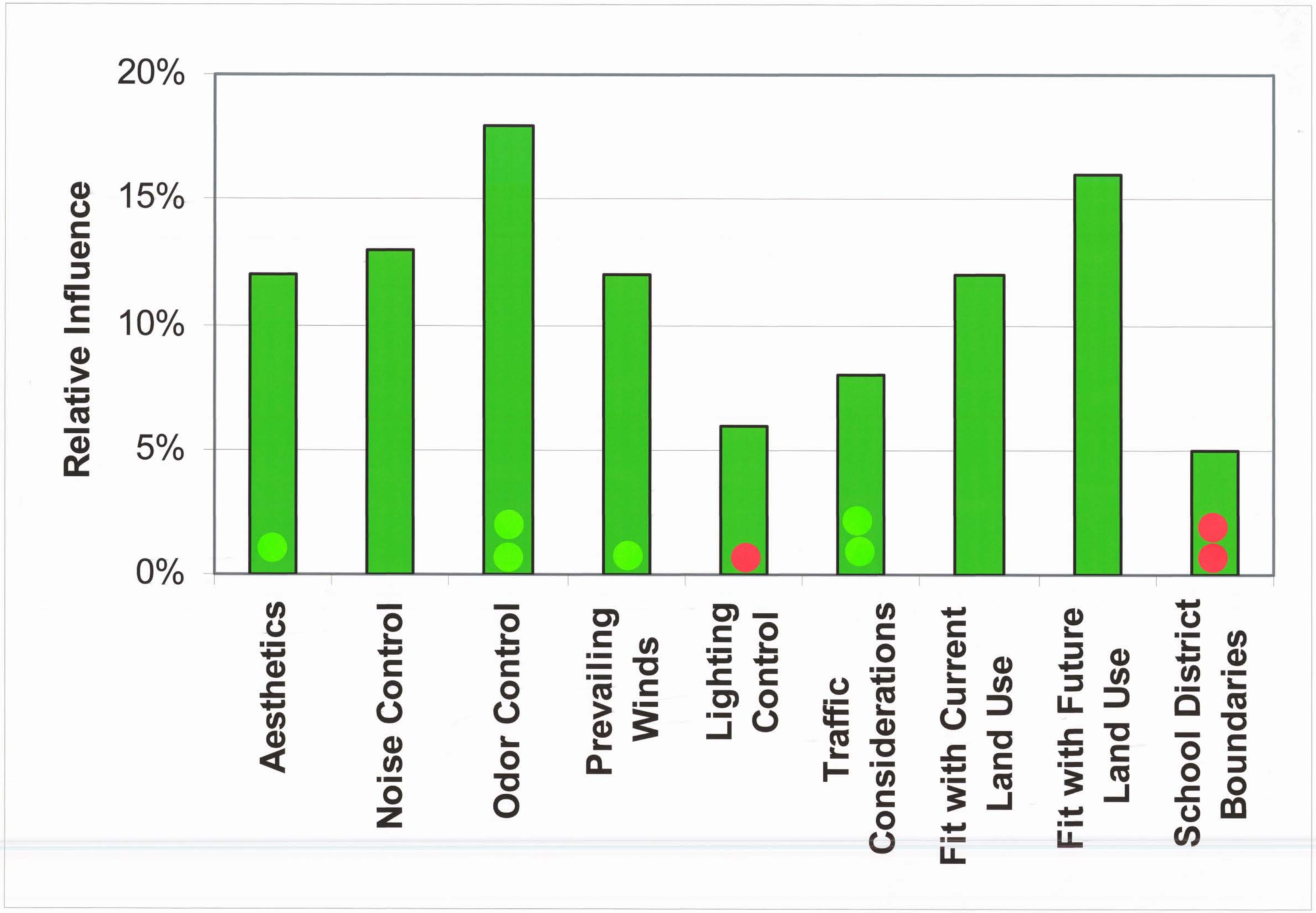
BLACK & VEATCH
Corporation
Kansas City, Missouri

LAWRENCE, KANSAS

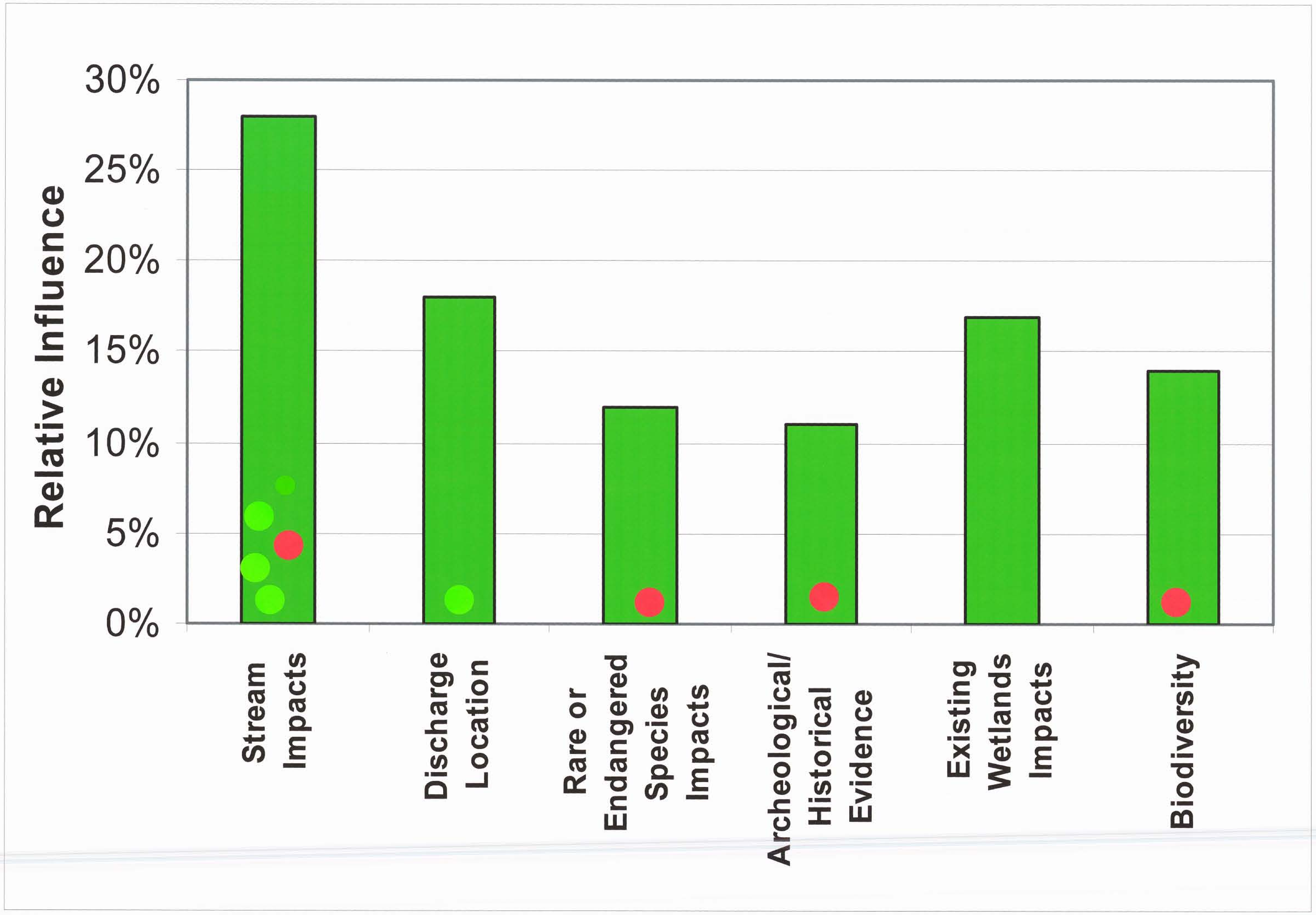
WAKARUSA WATER RECLAMATION FACILITY

BLACK & VEATCH
2005

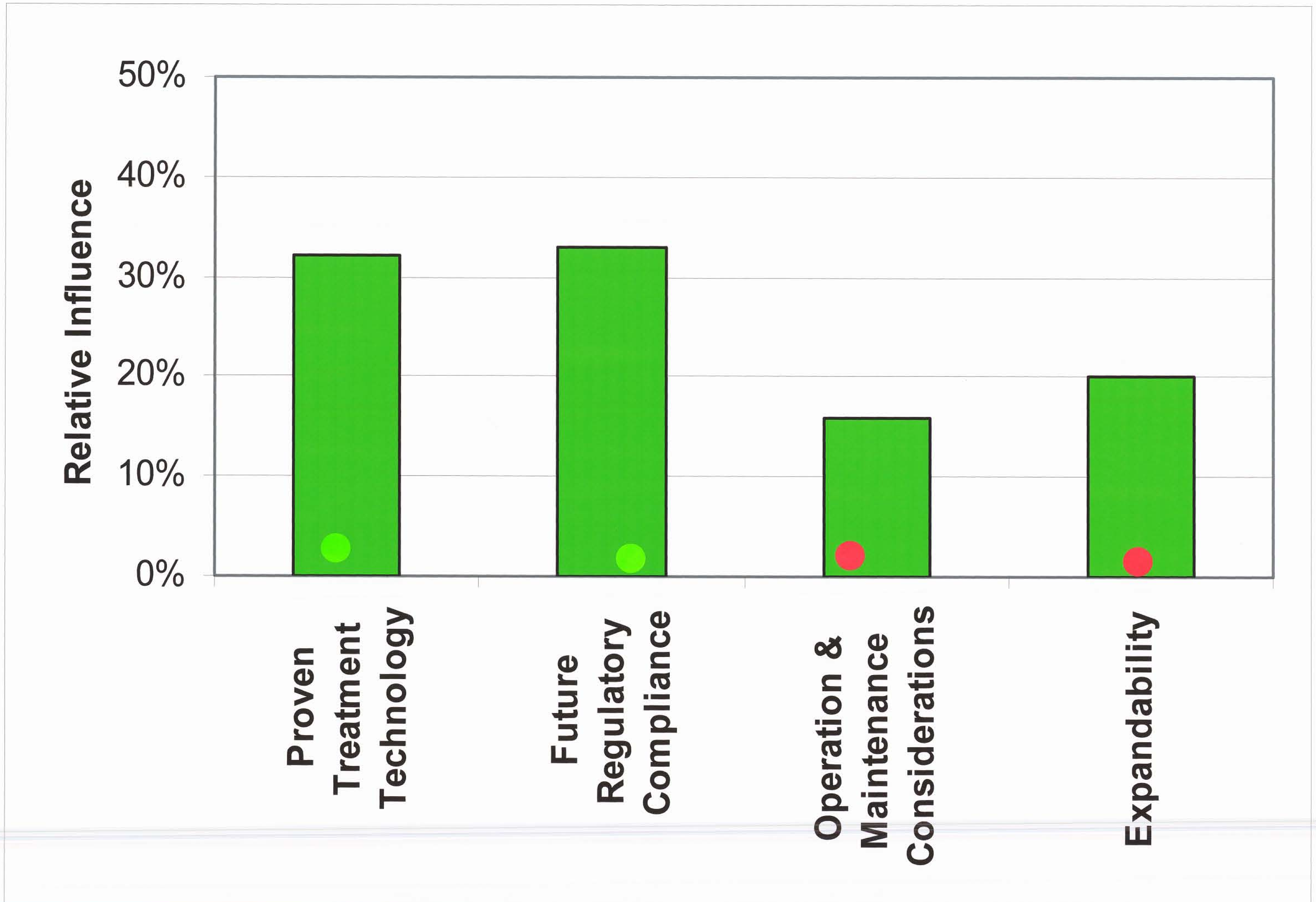
Community Sub-Criteria Average: PAC/Staff



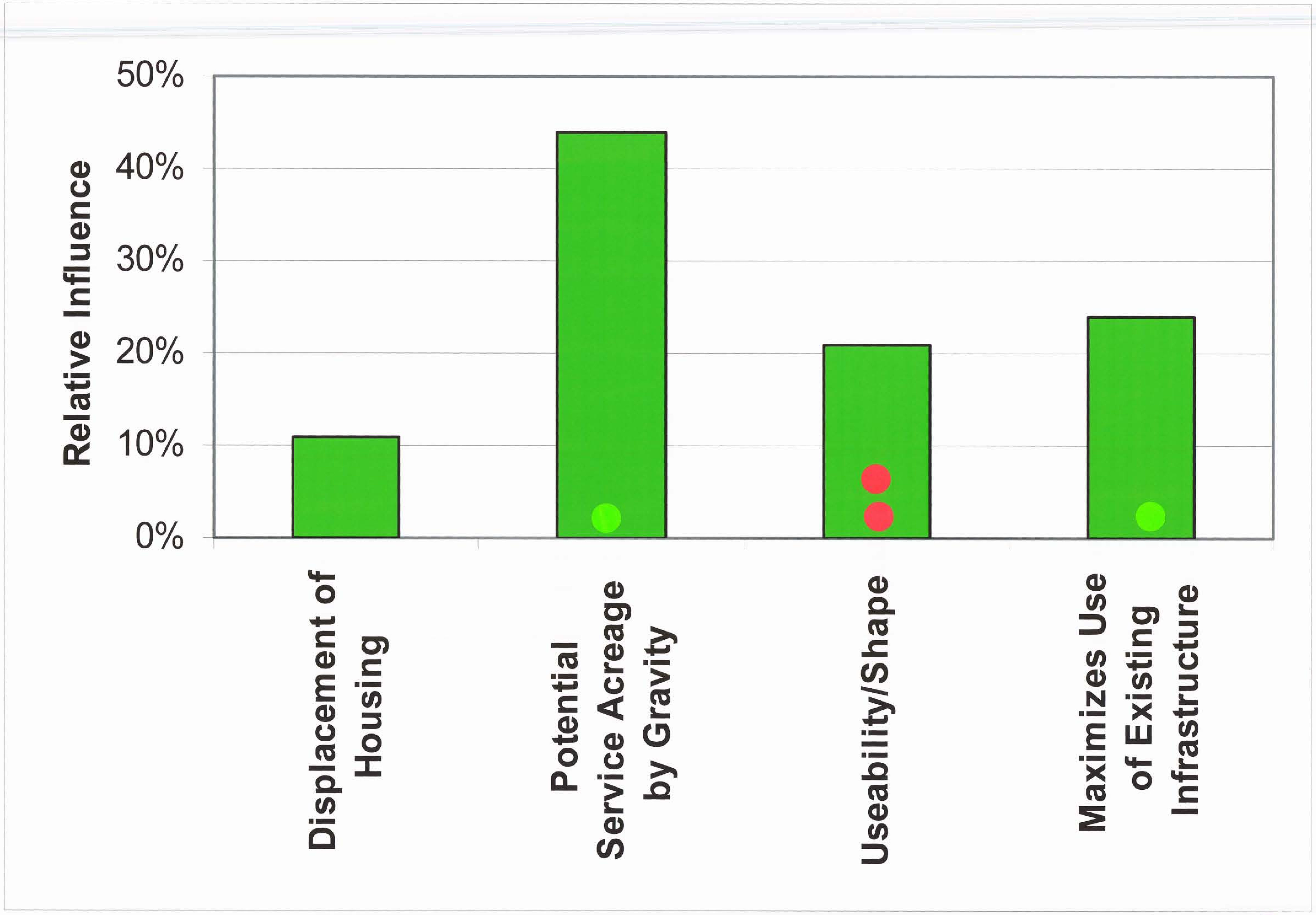
Environment Sub-Criteria Average: PAC/Staff



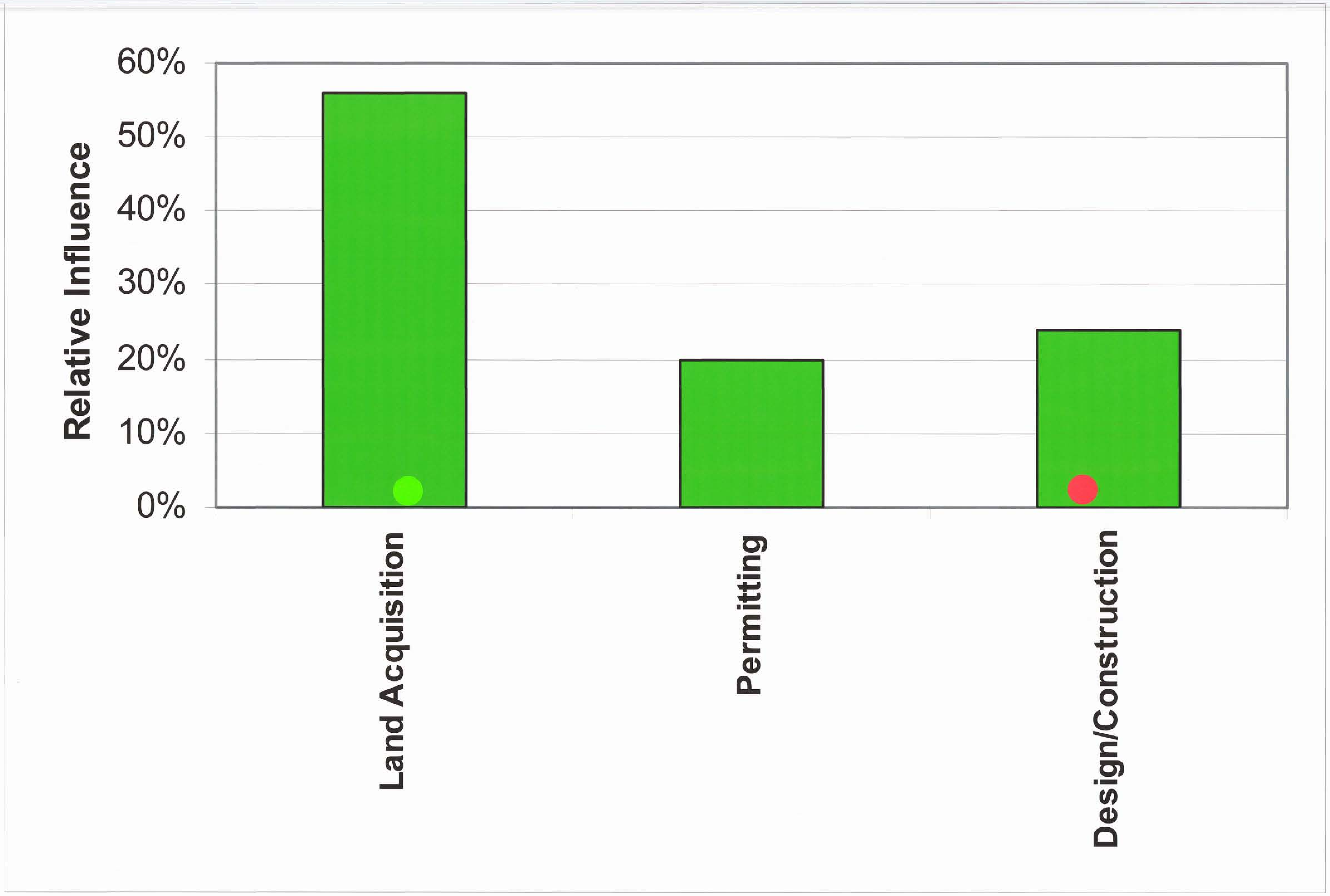
Process Sub-Criteria
Average: PAC/Staff



Land Sub-Criteria
Average: PAC/Staff



Schedule Sub-criteria
Average: PAC/Staff



MEETING MINUTES

Wakarusa WRF Public Advisory Committee (PAC) Workshop #3

Attendance:

Representatives from the Public Advisory Committee, City Staff, and Consultant Team were in attendance at the third PAC workshop held in City Hall, Commission Chambers from 4:00 to 7:00 PM on February 15, 2006.

<u>Public Advisory Committee:</u>

- Mary Lynn Stuart (Lawrence Preservation Alliance)
- Lavern Squier (Lawrence Chamber)
- Michael Caron (Save the Wetlands, Inc.)
- Warren Corman (University of Kansas)
- Rod Geisler (KDHE)
- Roger Pine (Pine family farms / Kansas Senate)
- Mike Bowman (Citizen at Large)
- Terry Riordan (Lawrence/Douglas County Planning Commission)
- Mike Amyx (City Commissioner)
- Mike Rundle (City Commissioner)

<u>City Staff:</u>

- Mike Wildgen (City Manger)
- Debbie Van Saun (Assistant City Manager)
- Lisa Patterson (Communications Manger)
- Philip Ciesielski (Utilities Engineer)
- Dan Warner (Planning Department)
- Dave Wagner (Assistant Director, Wastewater)
- Mark Hegeman (WWTP Superintendent)
- Jeanette Klamm (Biosolids Manager)

<u>Consultant Team:</u>

- Mike Orth, Page Surbaugh, and John Keller (Black & Veatch Corporation)
- Patti Banks and Lisa Briscoe (Patti Banks Associates)
- Joe Caldwell (Bartlett & West)
- John Pasley (HNTB)

Meeting Objective:

- Patti Banks (Patti Banks Associates) opened the meeting and outlined the meeting's agenda.
  - Status update on Eco-Machine Subgroup Activity
  - Review area rankings from last meeting
  - Rank areas with relation to criteria
  - Review content of public outreach campaign

Eco-Machine Activity:

- Debbie Van Saun (Assistant City Manager) summarized the Eco-Machine Subgroup activities to date. She said that to address the community's interest in Eco-Machines, a public forum should be held. Van Saun noted that an expert had yet to be invited to present at such a meeting. She said that the Peer Review group should be activated as part of the Eco-Machine discussion. David Austin (North American Engineers) was available to speak to the group the afternoon of March 1st from 3:00 to 4:00 p.m. or between 4:00 and 7:00 p.m. The EcoMachine public forum should be formatted as a public seminar followed by a PAC meeting similar to the Kadlec Wetlands Seminar which was followed by PAC Workshop #2. The agenda for the meeting could include the following:

- Presentation
- A question and answer period
- Peer Group discussion, observations, and application of all Eco-Machine components specifically to Lawrence
- Report the results of the meeting to the City Commission

- The PAC agreed that the meeting should be in Mid-March as a PAC wrap up to the process. PAC members stressed that one last PAC meeting should be held in March rather than two.

Review Alternatives:

- Mike Orth (Black & Veatch Corporation) summarized the three major footprint alternatives discussed at the January 18th PAC Workshop and outlined in the January 12, 2006 Memorandum and January 6, 2006 Memorandum-Ultimate Build-Out Acreage.
- Based on the 50 mgd estimate for ultimate build out capacity, Orth outlined the advantages and disadvantages of small, medium, and large footprint alternatives. He noted that there were seven (7) potential locations in Lawrence for the alternatives.

Review Ranking Process:

- Orth explained that as a part of the January Workshop, the Committee was provided with an aerial map showing the seven (7) areas to be considered, a preliminary alternative attributes form, and a preliminary rankings scorecard for reference. The attributes form provided a list of the sub-criteria considered, along with an abbreviated comment relating to the considered alternative. The color-coded scorecard illustrated the Consultant Team's up-to-date scoring of all criteria with a one to five ranking, where a score of five/darkest color represents the least impact (best), while one/lightest color demonstrates the highest impact (worst).

Review Community and Environment Rankings

- Page Surbaugh (Black & Veatch Corporation) explained that the group would review the Community and Environment sub-criteria presented in January in light of the Committee's responses and any supplemental detail provided by the Consultant Team and from PAC Workshop #2.

<u>Discussion: Community Sub-Criteria</u>

- Aesthetics - No Comment
- Noise Control - No Comment.
- Odor - No Comment
- Prevailing Winds - No Comment.
- Lighting Control - Technology enables targeted lighting solutions to eliminate glare.
- Traffic -
  - 1100 Road is a Major east-west arterial. Johnson County and Sunflower Ammunitions Plant are seeking a new road – Will it align with 1100 Road?
- Land Use - No Comment
- School District Boundaries -
  - Don't see immediate market for development adjacent to the new Water Reclamation Facility.
  - Don't rule out the east side.
  - What are the impacts to the Four Seasons Pumping Station?

Discussion: Environment Sub Criteria

- Stream Impacts - No Comment.
- Discharge Location - No Comment.
- Rare or Endangered Species - No Comment.
- Archeology - No Comment.
- Wetlands/Floodplain – What were the footprint rankings
- Biodiversity – No Comment.

Determine Land, Process, and Schedule Rankings:

- Mike Orth (Black & Veatch Corporation) explained that the group would review the land, process, and schedule sub-criteria in terms of best and worst scores. He also described the seven (7) potential sites included on the attributes tables that the Committee reviewed in January.

Discussion: Land Sub-Criteria

- Potential Service Area
  - ✓ Can you characterize the expense of tunneling?
  - ✓ Does everything within the city need to be pumped?
  - ✓ Debbie Van Saun requested the team to hone in on this issue of "Future Service Area" definitions and should focus on the future service acreage and make sure all are reported on the same basis.

- Usability and Shape
  - ✓ What's the difference in acreage for small, medium, and large sites?
  - ✓ Will you consolidate the rankings with the scores?
  - ✓ Why is one alternative better than the next?

- Maximum Use of Existing Infrastructure
  - ✓ Change the score and definition.
  - ✓ Serviceability is an issue – questioned orange and green delineations.
  - ✓ Explain the significant of existing plants and parking at this criterion?

- Displacement of Housing - No comment.

Discussion: Process Sub-Criteria

- Proven Treatment Technology
  - ✓ Is the technology proven?
  - ✓ What is the capital investment & cost benefit?
  - ✓ Has the wetlands example been done before? If so, do they move the solids or have problems with odors? Would the new Lawrence facility be similar?

- Expandability
  - ✓ Is the small footprint modular and when would you stop expanding its size?
  - ✓ Are there differential construction costs?

Discussion: Schedule Sub-Criteria

- Land Acquisition – No Comment.
- Permitting – No Comment.
- Design/Construction- No Comment

Public Meeting Results:

- Surbaugh explained that during the January Public Open House, the community was given the opportunity to comment on the five (5) sub-criteria through a dot exercise. She noted that the public and Committee shared similar concerns and that the public provided comment for each of the five sub-criteria.

Review Content of Public Outreach Campaign:

Banks explained that the public outreach campaign would consist of five (5) phased messages centered on a highly recognizable graphic that would evolve, gradually coming into focus, with each phase. The message will be disseminated on five (5) opportunities through use of 3 tools including kiosks located at high traffic location, water bill inserts, and a postcard mailing. Focus of the five opportunities includes: process, criteria, site selection, construction and time frame and process/update. Banks presented the posters illustrating the first three (3) phases of the campaign to the Committee along with a storyboard outlining the evolution of the campaign.

Information Sharing/Next Steps:

- Banks distributed a project fact sheet to the Committee to be used by members as a guide for sharing the results of this process with each of their respective constituencies. The fact sheet also included a section for information sharing that provided a summary of the need for the new water reclamation facility, a project timeline, a process description, and the criteria to be considered for siting the facility.

Next PAC Meeting:

- Banks explained that the Eco-Machine presentation was tentatively scheduled for March 1, 2006. The PAC will reconvene in 12 – 18 months to provide comments the design of the proposed water reclamation facility. Banks emphasized that the project would need the involvement of 2-3 interested PAC members during implementation and that interested members should send their requests to be involved via email to Black & Veatch.

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Memorandum
City of Lawrence
City Manager's Office

To: **Dave Corliss**
Interim City Manager
From: **Debbie Van Saun**
Asst. City Manager
cc: **Dave Wagner, Asst. Utilities Director**
Date: **March 7, 2006**
Re: **Summary from 030106 PAC meeting**

On March 1, 2006, the Public Advisory Committee (PAC) participated in a public meeting that included the following agenda items:

- Presentation by Jonathan Todd of the Eco Machines (formerly Living Machine) technology
- Question/answer period from public, Peer Review Group, and PAC
- Discussion by PAC with goal of submitting recommendation to City Commission

The memo serves as a summary of the comments provided and activities accomplished during this public meeting.

Background Information

As part of the public participation and outreach component of the Wakarusa Water Reclamation Facility project, the Mayor appointed, with City Commission approval, a Public Advisory Committee comprised of representatives holding a variety of perspectives (e.g. regulatory, environmental, property interests, etc.). The mission of this group is to guide the public participation process by serving as the voice of the community throughout the development of the project, providing input regarding site utilization concepts and appearance related to the facility. The PAC has been meeting on a regular basis to research the suitability of various sites prior to the initiation of land acquisition negotiations. Nearing the end of that process, some members of the PAC requested, and the City Commission approved, an opportunity to educate the community about the Edo Machine technology as it might relate to a municipal application in Lawrence. To that end, staff and members of the PAC made arrangements for Mr. Todd's presentation, as well as the other items included in the aforementioned agenda.

The peer review group concept was developed early in the project to provide a "sounding board" for the professional review of any issues that might come up during the course of the project. The credentials of the peer review group utilized for this issue are attached.

Public Meeting Discussion & PAC Recommendation

Mr. Todd's presentation is available on the City's website. The following reflects a summary of the minutes taken at the public meeting during the question and answer period and the subsequent PAC discussion:

- Pretreatment would be needed with the Eco Machine technology in certain situations, just as it is needed in conventional treatment.
- For some toxic elements, Eco Machines are robust for small scale but on a large scale, any advantage is lost.
- Space needs for Eco Machines – we received a variety of estimates on this topic; it appears to be an issue that would be addressed in the design phase. There was agreement that outdoor wetlands require more space than conventional treatment and this space could be reduced by considering a contained wetland.
- The Eco Machine technology would be designed for the "worst case scenario" in regards to climate.
- The plants involved in the Eco Machine technology, when used in a small system (defined as under 100,000 gallons per day) work reasonably well in nutrient removal, provided the nitrogen and phosphorous levels are low. In larger systems, the plants may be more decorative in nature and do not significantly contribute to the treatment process.
- Johnson County has done a considerable amount of planning and analysis on the topic of centralized versus decentralized systems. Johnson County Wastewater concluded that decentralization was not an appropriate approach because it encourages leap frog development and the potential for additional discharge permits and associated water quality monitoring and reporting.
- The KDHE representative on the peer review committee indicated an interest in Eco Machine technology for small communities across Kansas in lieu of typical wastewater lagoons.
- Eco Machines are typically associated with applications where the amount and strength of flow is consistent and are not well suited for municipal systems with Inflow and Infiltration (I/I) and less reliable strength flows.
- In terms of scalability, contained wetland treatment in a municipal application isn't feasible for systems greater than 500,000 gallons per day.
- El Dorado is using an approach that combines a mechanical plant for daily flows and wetlands for excess flow treatment during significant rain events.
- Again addressing scalability and the Eco Machine technology within a greenhouse facility, there are a very small number of plants that can produce roots two to three feet long, which is needed for the process. Plants need to be in shaded areas and the heat dissipation issue is significant within a greenhouse. OSHA requirements for workers in the greenhouse would also be a concern due to heat exposure.
- Both of the experts in the Eco Machine technology were not supportive of using the technology in a 7 MGD facility application.
- If used in an industrial area or for small developments, the Eco Machine technology may be more appropriate.
- After additional PAC discussion, there was consensus to continue pursuing a centralized system that allows for a review of alternate process means that would

fit in the applicable footprint. This approach ended up being the recommendation that was acceptable to be forwarded to the City Commission.

- Comments throughout the PAC discussion following the presentation and question/answer period were consistently favorable and positive regarding this opportunity to learn more about the Eco Machine technology.

City Commission Action

City Staff and members of the PAC request the City Commission to receive the PAC recommendation: *For the Wakarusa Water Reclamation Facility project, continue to pursue a centralized system for wastewater treatment facility for discharge to the Wakarusa River. During the treatment analysis phase, direct Black & Veatch to consider and review any alternate process means (e.g. pre-treatment and/or post treatment) that would fit in the applicable footprint for the selected site.*

Agenda
Public Meeting No. 1
Wakarusa Water Reclamation Facility

Date: November 3, 2005
Time: 7:00 to 8:30 pm
Location: South Junior High School

Introductions **5 minutes**

Project Team **10 minutes**

- City Staff
  - End user of facility
- Public Advisory Committee
  - Conduit for public input
  - Engagement through the evaluation process
- Black & Veatch
  - Technical Consultant for wastewater collection & treatment
- Patti Banks Associates
  - Outreach coordinator
- Bartlett & West
  - Surveying
- HNTB
  - Permitting
- General population at large
  - Input on acceptability, site utilization, & aesthetics.

Wastewater 101 **15 minutes**

- Review role of the collection system
- General wastewater treatment review
- Wastewater treatment plant vs. water reclamation facility
- Typical concerns
  - Control of odor
  - Aesthetics/architectural character
  - Impacts of noise
  - Control plant and site lighting
  - Control of truck traffic
  - Property value impacts
  - Others?

Agenda
Public Meeting No. 1
Wakarusa Water Reclamation Facility

<u>Project Overview</u> **15 minutes**

- Why we are here today
- Timeline
- Study area considerations
    - No preconceived locations
    - Accommodate gravity flow to the extent possible
    - Existing collection system
    - Wetlands
    - Cultural & historic locations
    - Engineering issues
        - Cannot build in floodway
        - Floodplain considerations
        - Environmental permitting
        - Site geology
        - Site topography
        - Proximity to utilities
        - Proximity to roadways
        - Affordable within rate plan

<u>Introduction to Process</u> **15 minutes**

- Public input into criteria for selection
    - Public acceptability factors
    - Site utilization/compatibility with land use
    - Appearance
- Stakeholder Interviews
    - Currently being scheduled/conducted
- Peer Group Roles
    - Peer group qualifications
- Description of Process
    - Stakeholder Interviews
    - Workshops
    - Public meetings

<u>Questions and Answers</u> **15 minutes**

<u>Open House</u> **15 minutes**

Wakarusa Water Reclamation Facility
Public Introductory Meeting

November 3, 2005
7:00 to 8:30 pm

South Junior High School
2734 Louisiana

HNTB

PBA
PATTI BANKS ASSOCIATES

BLACK & VEATCH
building a world of difference™
ENERGY WATER INFORMATION GOVERNMENT

BARTLETT & WEST ENGINEERS
SERVICE. THE BARTLETT & WEST WAY.

Constructed Wetlands: State of the Science

Engineered

Plant, Substrate and Water Systems

for

Water Quality Improvement

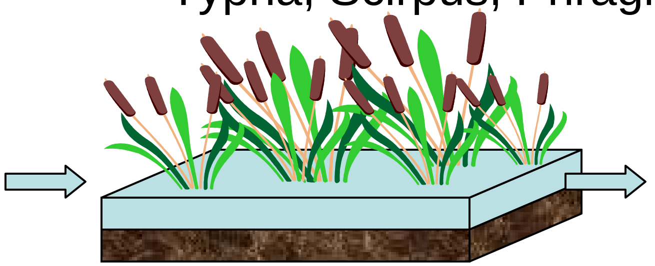
SSCW1

Agenda

- Types of wetland treatment systems
- Examples
- How wetland treatment works
- Levels of treatment
- Design requirements
- Operation and maintenance considerations
- Questions

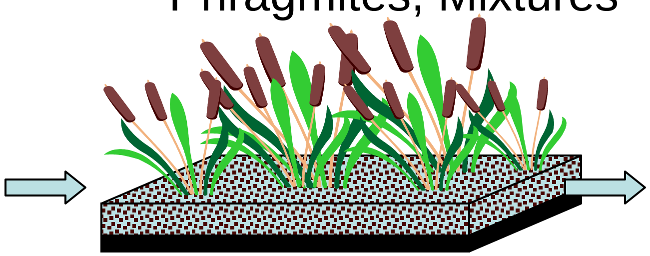
Principal Types and Characteristics

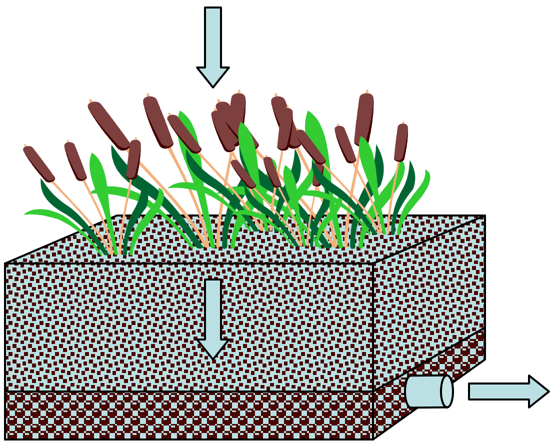
Free Water Surface:
30 - 80 cm (12 – 32 in) deep water
0.02 - 75 cm/d (0.007 – 30 in/day)
0 - 65° north
Typha, Scirpus, Phragmites



Vertical Subsurface Flow:
80 - 120 cm (32 to 47 in) deep gravel
5 - 25 cm/d (2 to 10 in/day)
Phragmites, Typha

Horizontal Subsurface Flow:
30 - 80 cm (12 – 32 in) deep gravel
5 - 75 cm/d (2 to 30 in/day)
0 - 65° north
Phragmites, Mixtures



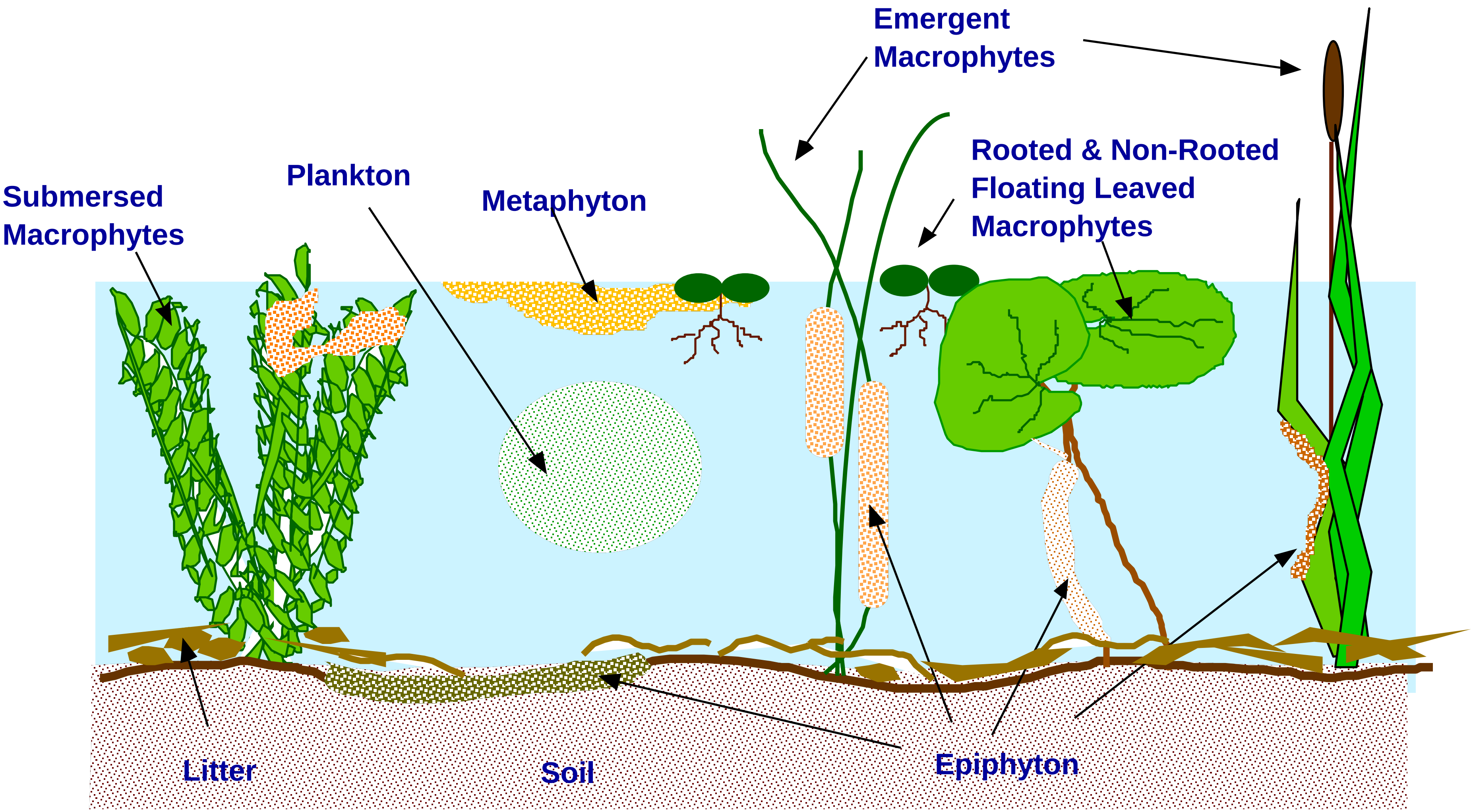


Examples of Wetland Systems

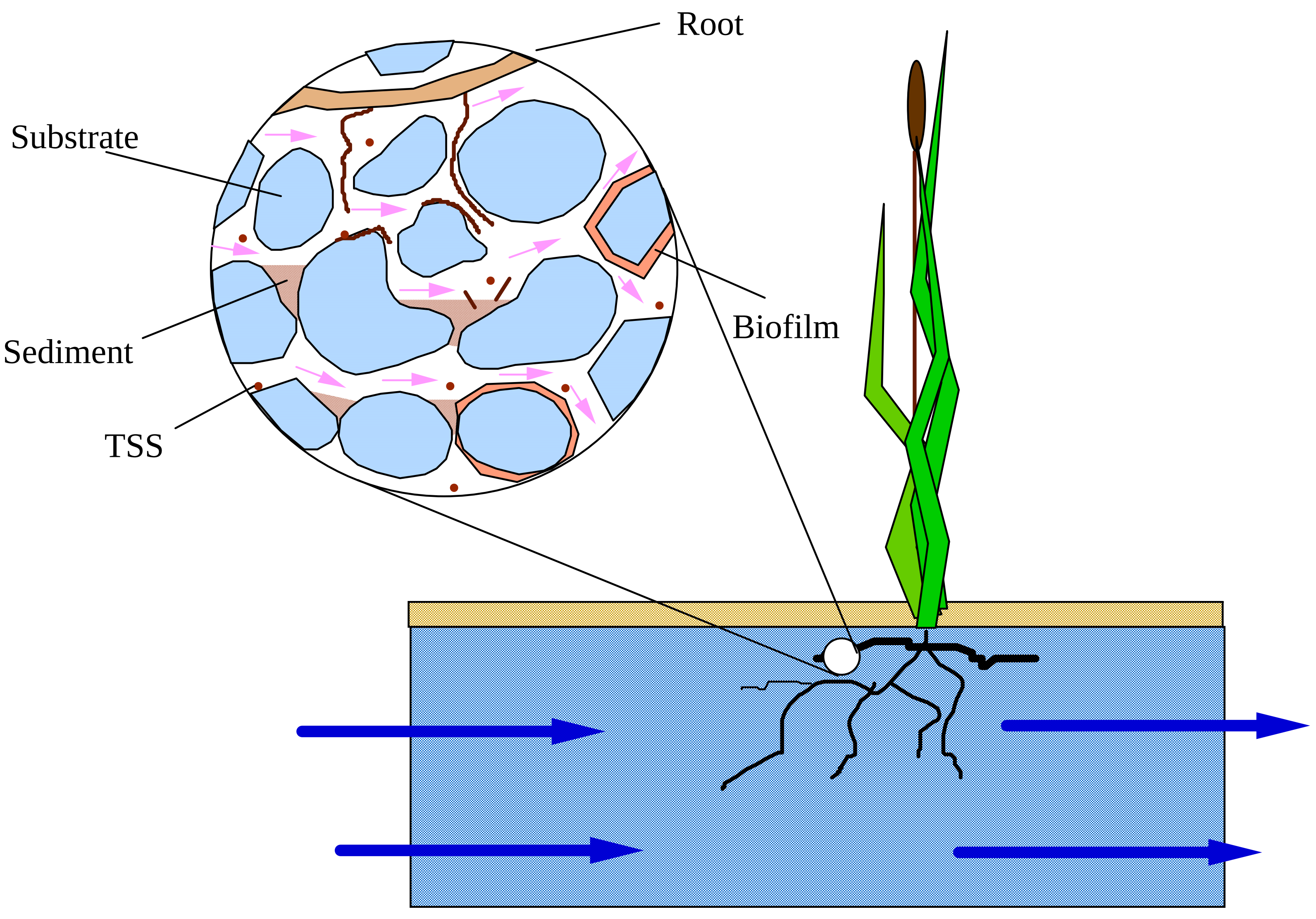
- Southern Portugal
- Single family on-site
- Goal: reuse
- Septic tank effluent, Subsurface Flow

- Southern Florida Free Water Surface
- Landscape scale
- Goal: Everglades protection
- Agricultural field runoff

Structure of a Free Water Surface Wetland



Structure of a Subsurface Wetland

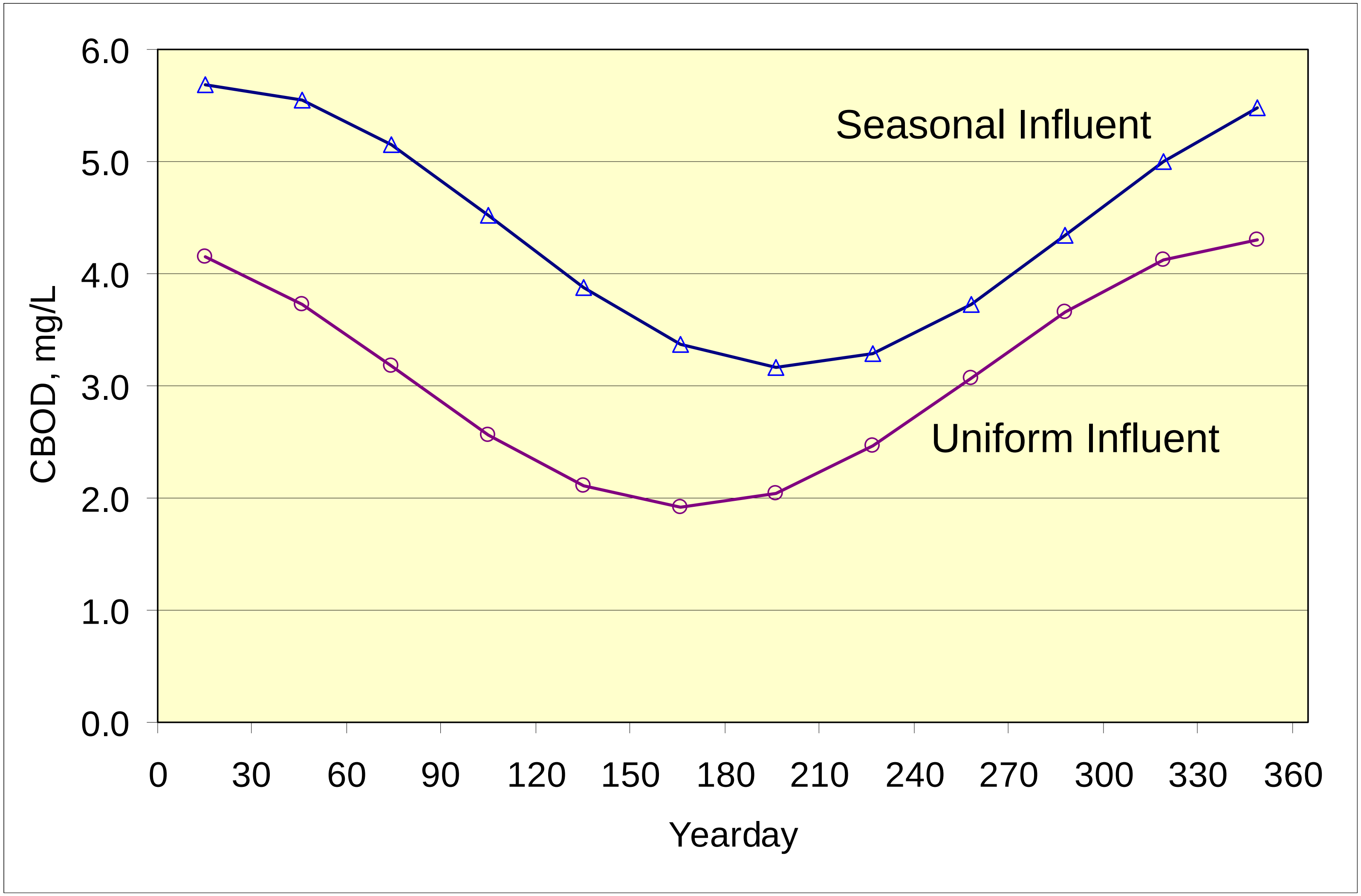


SSCW6

Pollutant Removals

- Dependent on a number of factors including
  - Influent loadings
  - Air/water temperature
  - Flows
  - Other factors

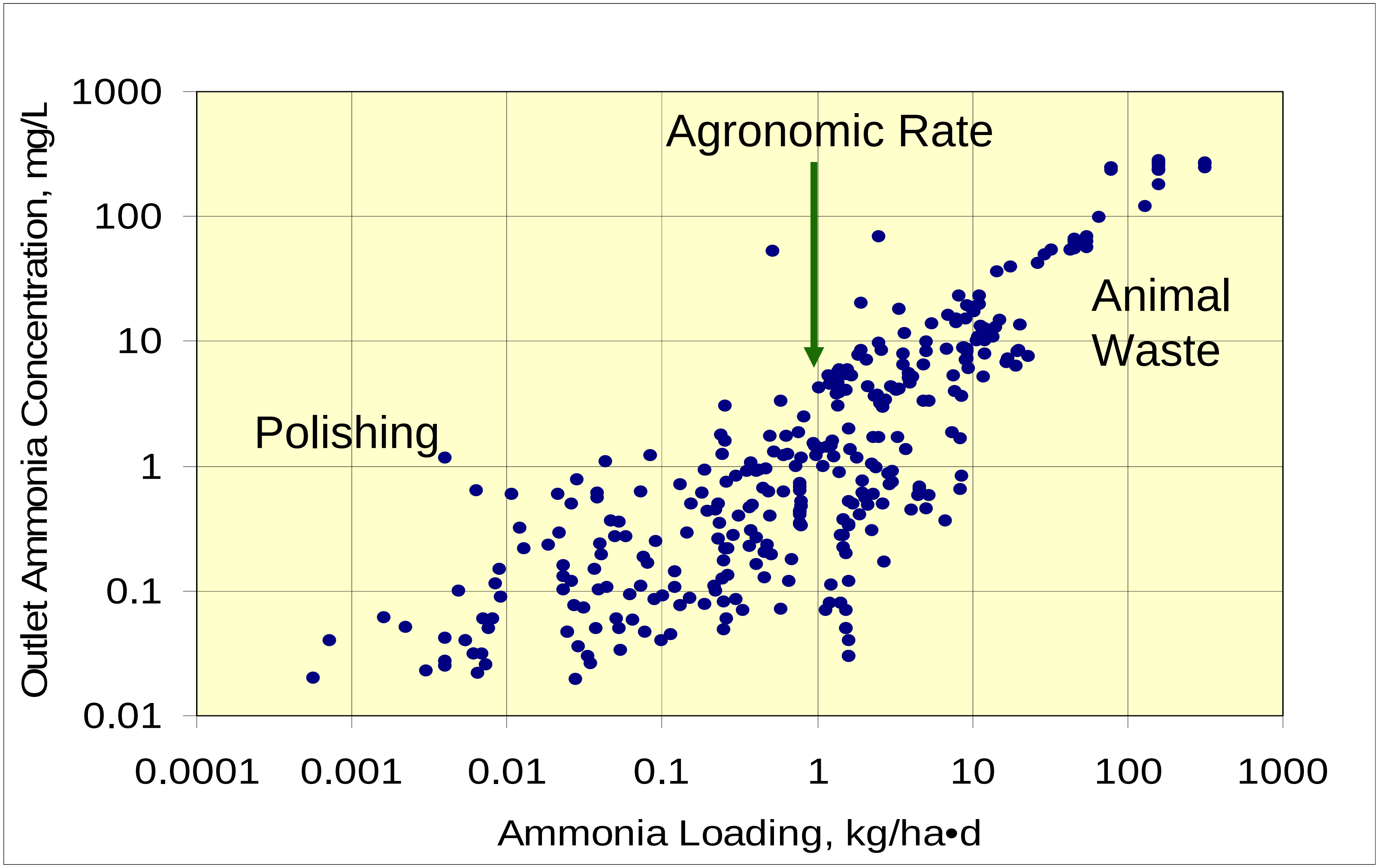
Seasonal Wetland Effluent BOD



Suspended Solids

	TSS In	TSS Out
FWS		
Listowel, ONT	111	8
Fort Deposit, AL	91	13
Augusta, GA	19	9
Columbia, MO	13	8
Lakeland, FL	5.7	2.9

FWS Ammonia Removal



1 kg/ha-day = 0.9 pounds/acre-day)

Design Requirement for Wetlands

- Flow rate
- Influent wastewater loading
- Effluent requirements
- Temperature
- Seasons
- Vegetation
- Access

Operation and Maintenance and Startup Requirements

- What are they?
- Are there issues with animals?
- What should the City expect?
- What is operational changes are required during wet or cold weather?
- Vegetation type and growth?
- After the wetland is built, is it ready to be used on Day 1?

Human Use

Ancillary Benefits

Wildlife Use

Summary

- The fifty year history of engineered treatment wetlands has been marked by exponential growth, in scientific knowledge, numbers of systems, and types of applications.
- Constructed wetlands are practical, economical, and user-friendly.
- Constructed wetlands are not a stand-alone technology.
- Constructed wetlands often require large land areas, are subject to natural stochastic behavior, and have few adjustable controls.

Constructed Wetlands:
Wakarusa Considerations

Supporting Information and Projects

Conceptual Reference Alternatives

BIG Constructed Wetlands

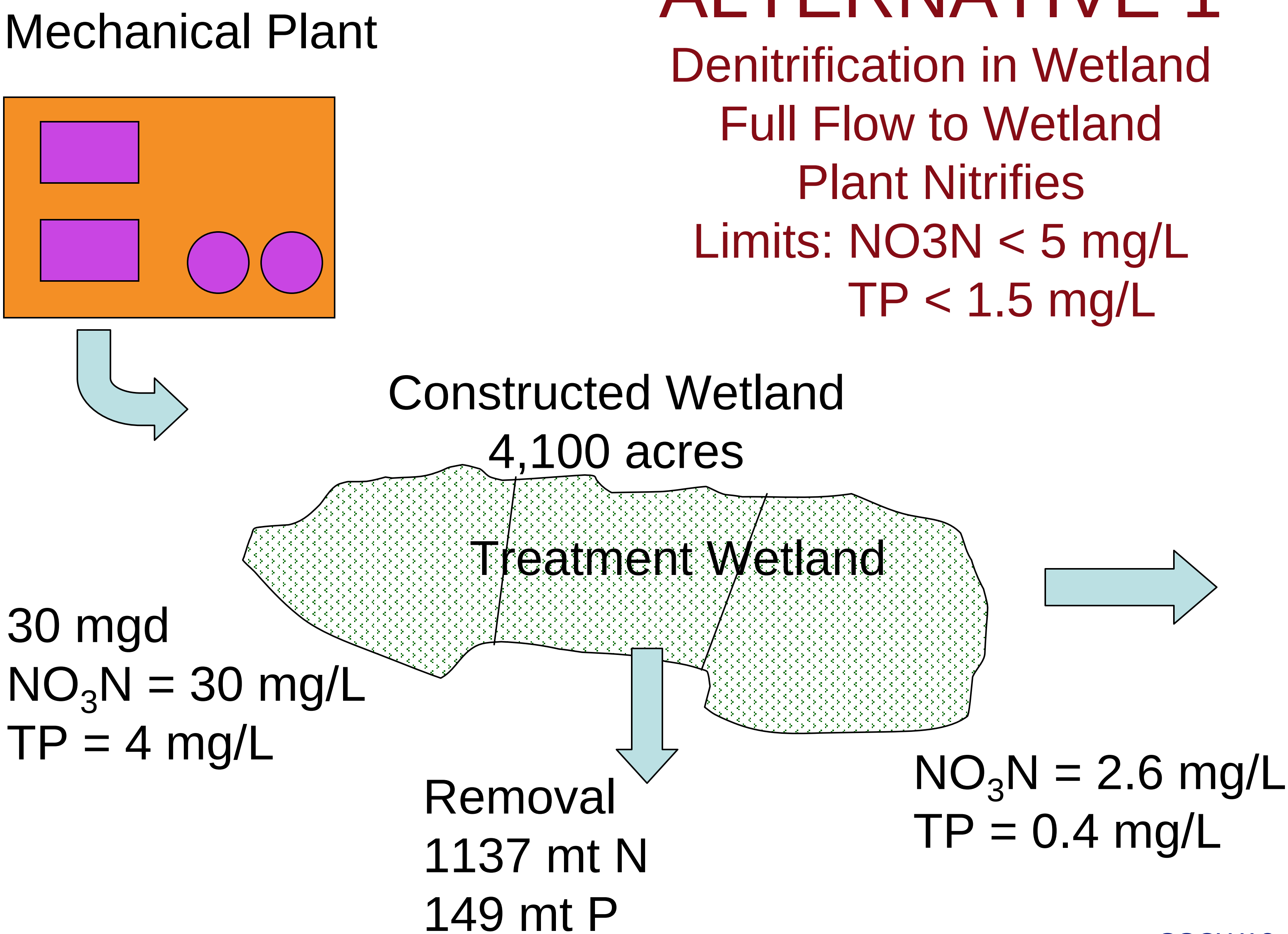
	Acres	Functions
Beaumont, TX	650	Ammonia reduction, public use
Vorup Enge, Denmark	295	Non-point nitrate , public use
Columbia, MO	131	BOD & TSS reduction
Calgary, Alberta	370	Urban stormwater (in design)
Phoenix, AZ	420	Green space, polishing (in design)
Orlando Easterly, FL	1220	Polishing
Prado, CA	150	Nitrate control
Everglades, FL (six)	800 - 14,000	Phosphorus control for agricultural runoff

Wetland Alternatives (Preliminary)

- Treatment after mechanical plant to achieve TN and TP removal
- Set area…what additional treatment can be achieved
- Side stream treatment…smaller flow

ALTERNATIVE 1

Denitrification in Wetland
Full Flow to Wetland
Plant Nitrifies
Limits: NO3N < 5 mg/L
TP < 1.5 mg/L



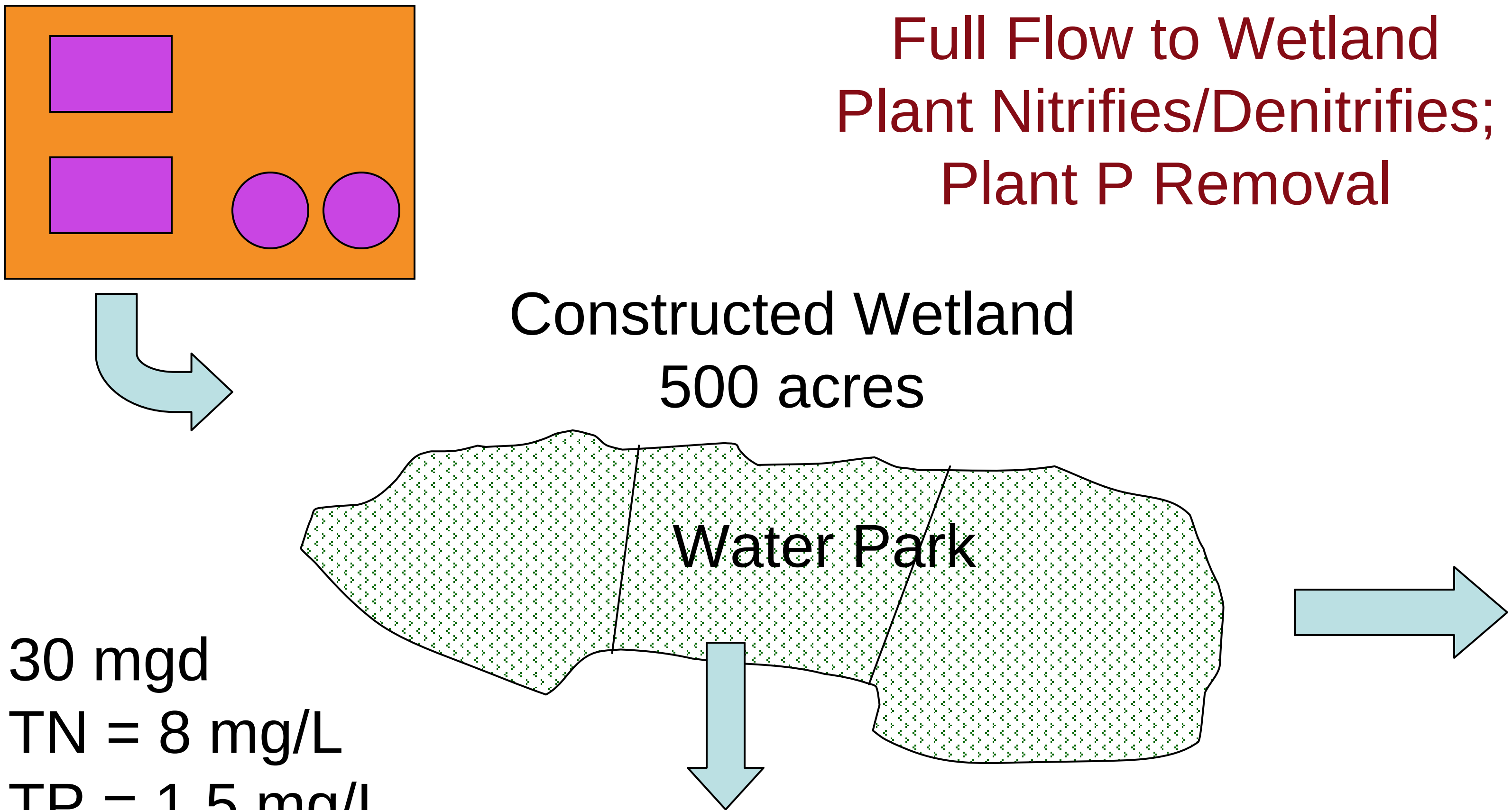
SSCW18

ALTERNATIVE 2

Polishing
Full Flow to Wetland
Plant Nitrifies/Denitrifies;
Plant P Removal

Mechanical Plant

Constructed Wetland
500 acres



30 mgd
TN = 8 mg/L
TP = 1.5 mg/L

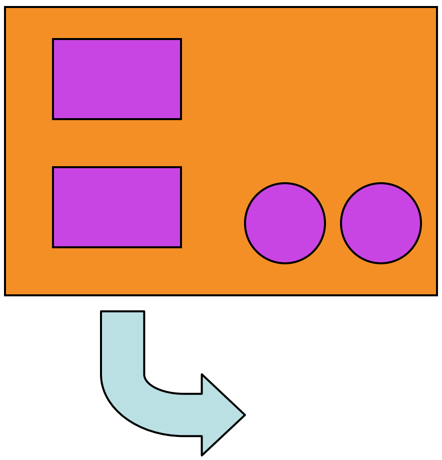
Removal
138 mt N
32 mt P

TN = 4.7 mg/L
TP = 0.7 mg/L

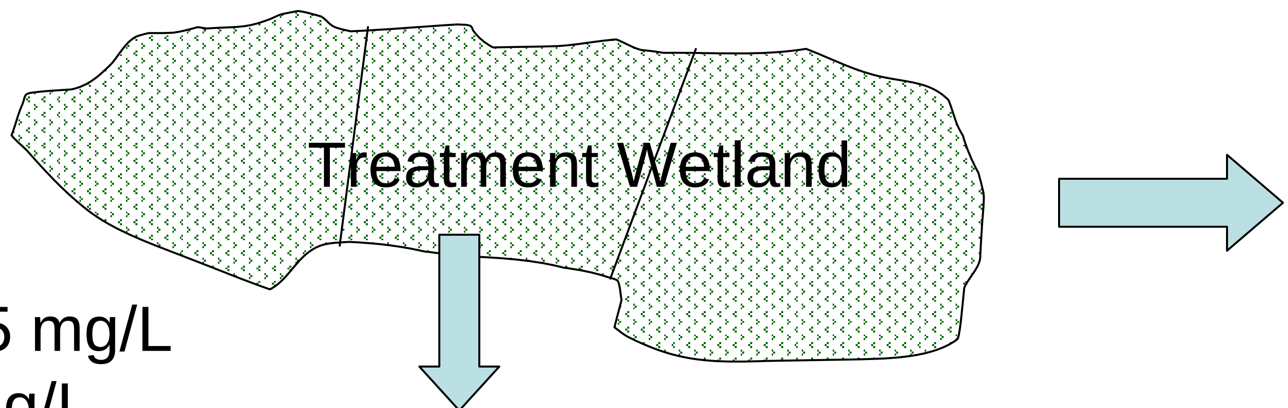
ALTERNATIVE 3

Sidestream to Wetland
Plant Nitrifies
Limits: NO3N < 5 mg/L
TN < 8 mg/L

Mechanical Plant



Constructed Wetland
250 acres



3 mgd
NO_3N = 25 mg/L
TN = 27 mg/L
TP = 1.5 mg/L

Removal
94 mt N
5.8 mt P

NO_3N = 2.4 mg/L
TN = 4.4 mg/L
TP = 0.09 mg/L

MEETING MINUTES

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- Dave Wagner (Assistant Director, Wastewater)
- Mark Hegeman (WWTP Superintendent)
- Jeanette Klamm (Biosolids Manager)

<u>Consultant Team:</u>

- Mike Orth, Page Surbaugh, and John Keller (Black & Veatch Corporation)
- Patti Banks and Lisa Briscoe (Patti Banks Associates)
- Joe Caldwell (Bartlett & West)
- John Pasley (HNTB)

Meeting Objective:

- Patti Banks (Patti Banks Associates) opened the meeting and outlined the meeting's agenda.
  - o Status update on Eco-Machine Subgroup Activity
  - o Review area rankings from last meeting
  - o Rank areas with relation to criteria
  - o Review content of public outreach campaign

Eco-Machine Activity:

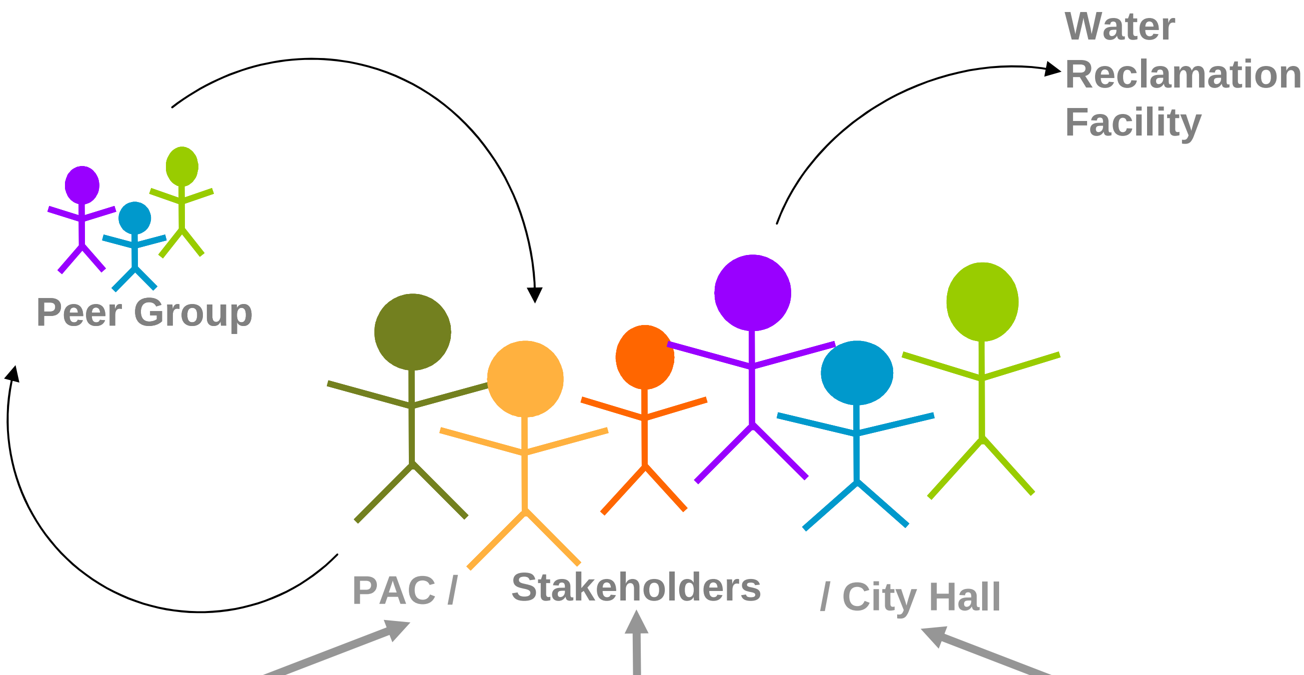
- Debbie Van Saun (Assistant City Manager) summarized the Eco-Machine Subgroup activities to date. She said that to address the community's interest in Eco-Machines, a public forum should be held. Van Saun noted that an expert had yet to be invited to present at such a meeting. She said that the Peer Review group should be activated as part of the Eco-Machine discussion. David Austin (North American Engineers) was available to speak to the group the afternoon of March 1st from 3:00 to 4:00 p.m. or between 4:00 and 7:00 p.m. The EcoMachine public forum

Questions

Agenda

- Welcome
- Introductions
- Wastewater 101
- Project Overview
- Introduction to Process
- Questions & Answers
- Group Feedback

Introduction of Wakarusa Water Reclamation Facility Project Team



Community

Patti Banks Associates

Environment

HNTB

Dr. Robert Kadlec

Dr. Roger Boyd

Technology

Black & Veatch

Bartlett & West

PAC Members

- **Mr. Mike Amyx**
  City of Lawrence
  Vice-Mayor
- **Mr. Mike Rundle**
  City of Lawrence
  Commissioner
- **Mr. Charles Jones**
  Douglas County – Board of County Commissioners
  Chairman/1st District Commissioner
- **Mr. Roger Pine**
  State of Kansas Senate
  3rd District Senator/Farmer

PAC Members

- **Dr. Terry Riordan, MD**
  Lawrence/Douglas County Planning Commission
  Chair
- **Mr. Tom Bracciano**
  Lawrence Public Schools – Facilities & Operations Planning
  Division Director
- **Mr. Warren Corman**
  University of Kansas – Business & Financial Planning
  University Architect
- **Mr. Rod Geisler**
  Kansas Department of Health & Environment – Bureau of Water
  Chief, Municipal Programs

PAC Members

- **Mr. Lavern Squier**
  Lawrence Chamber of Commerce
  President and CEO
- **Mr. Michael Campbell**
  Kansas Sierra Club (Wakarusa Group)
  Chair
- **Ms. Mary Lynn Stewart**
  Lawrence Preservation Alliance
  Secretary
- **Mr. Michael Caron**
  Save the Wakarusa Wetlands
  President

PAC Members

- **Ms. Carrie Lindsey**
  League of Women Voters – Lawrence/Douglas County
  President
- **Mr. Ross Marshall**
  Kansas City Area Historic Trails Association
  Secretary
- **Ms. Alison Reber**
  Kaw Valley Heritage Alliance – Kansas StreamLink Program
  Executive Director
- **Ms. Bobbie Flory**
  Lawrence Home Builders Association
  Executive Director

PAC Members

- **Mr. Michael Almon**

  Interested Citizen
- **Ms. Laura Calwell**

  Kansas Riverkeepers – Friends of the Kaw
- **Mr. John Craft**

  Neighbor to Kaw Wastewater Treatment Plant

City Staff

- **Mike Wildgen,** City Manager
- **Debbie Van Saun**, Assistant City Manager
- **Dave Wagner**, Assistant Director Wastewater
- **Lisa Patterson**, Communications Manager
- **Philip Ciesielski**, Utilities Engineer
- **Mark Hegeman**, Wastewater Treatment Manager
- **Jeanette Klamm**, Residuals Coordinator

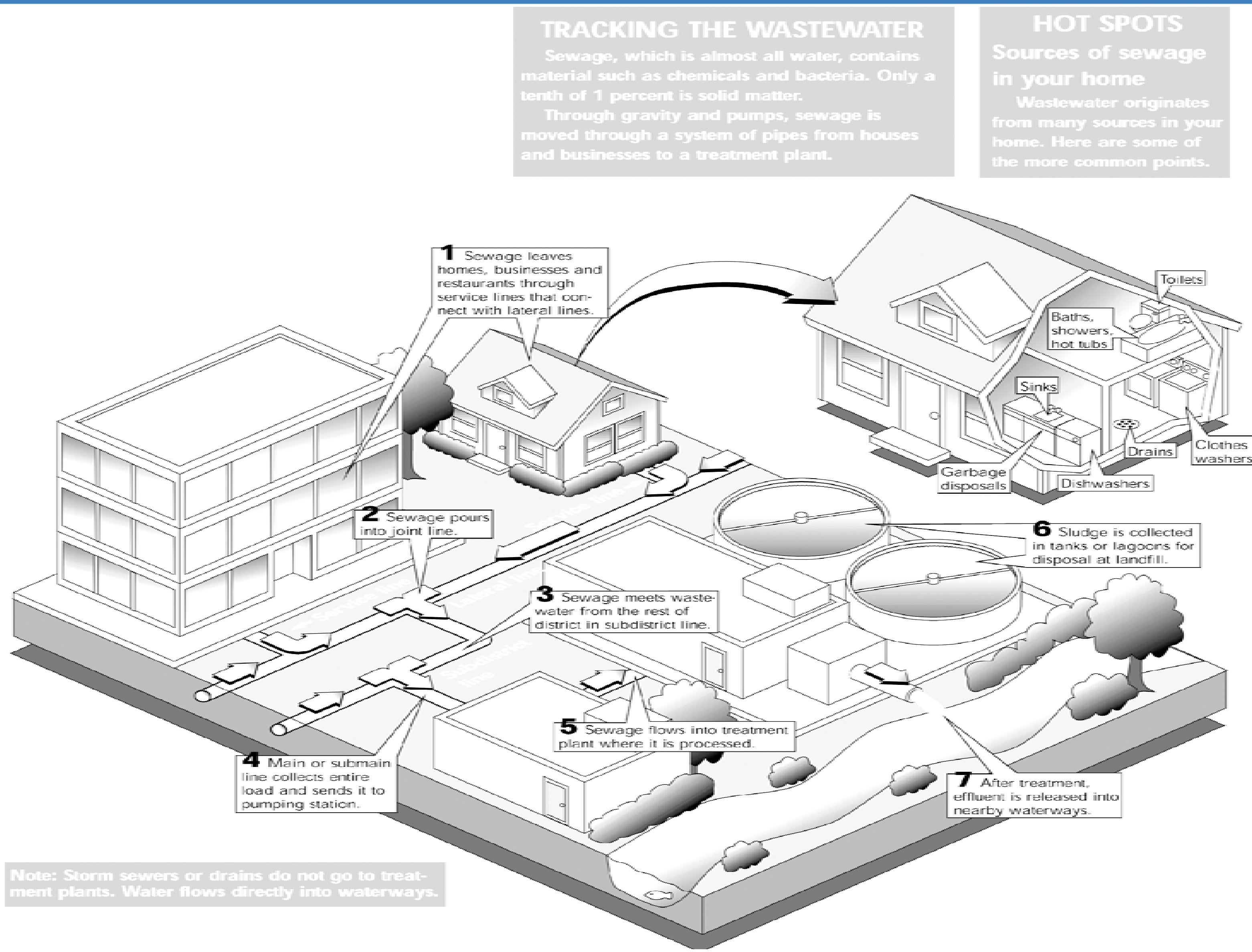
Project Team

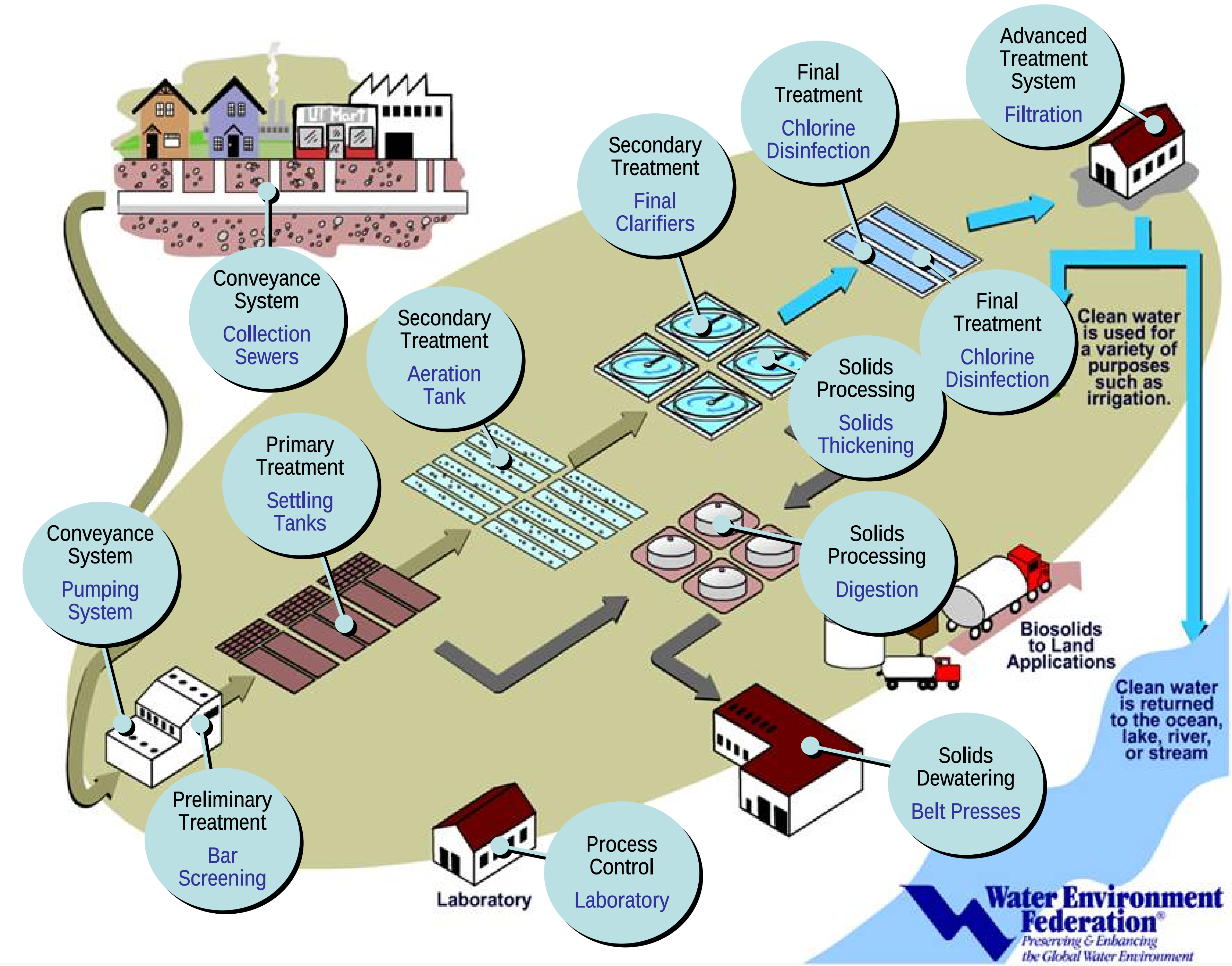
- **Black & Veatch**
  - Mike Orth, Project Director
  - John Keller, Project Manager
  - Cindy Wallis-Lage, Process Department Head
  - Page Surbaugh, Design Engineer
- **Patti Banks Associates**
  - Patti Banks
  - Lisa Briscoe

Project Team

- **HNTB**
  - John Pasley
  - Jennifer Johnson
- **Bartlett & West**
  - Joe Caldwell

Wastewater Collection and Treatment Process Overview




Conveyance System
Collection Sewers
Conveyance System
Pumping System
Preliminary Treatment
Bar Screening
Primary Treatment
Settling Tanks
Secondary Treatment
Aeration Tank
Secondary Treatment
Final Clarifiers
Final Treatment
Chlorine Disinfection
Advanced Treatment System
Filtration
Final Treatment
Chlorine Disinfection
Clean water is used for a variety of purposes such as irrigation.
Solids Processing
Solids Thickening
Solids Processing
Digestion
Biosolids to Land Applications
Clean water is returned to the ocean, lake, river, or stream
Solids Dewatering
Belt Presses
Laboratory
Process Control
Laboratory
Water Environment Federation®
Preserving & Enhancing the Global Water Environment

What is the difference between a wastewater treatment plant and a water reclamation facility?

- **Wastewater Treatment Plant**
  – treats collected wastewater
- **Water Reclamation Facility**
  – treats collected wastewater, providing a beneficial reuse of a portion of the waste products

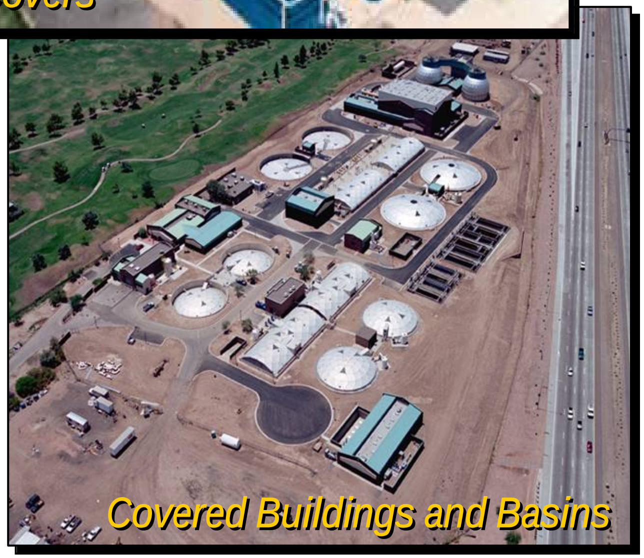
Typical Concerns Associated with Wastewater Treatment

- Control of Odors
- Aesthetics/Architectural Character
- Impacts of Noise
- Control of Plant and Site Lighting
- Control of Truck Traffic
- Property Value Impacts
- Others?

Control of Odors

- Minimize odor generation and release of hydrogen sulfide (H_2S)
- Operations/buffer space
- Effectively cover, ventilate, and scrub

Fabric Covers

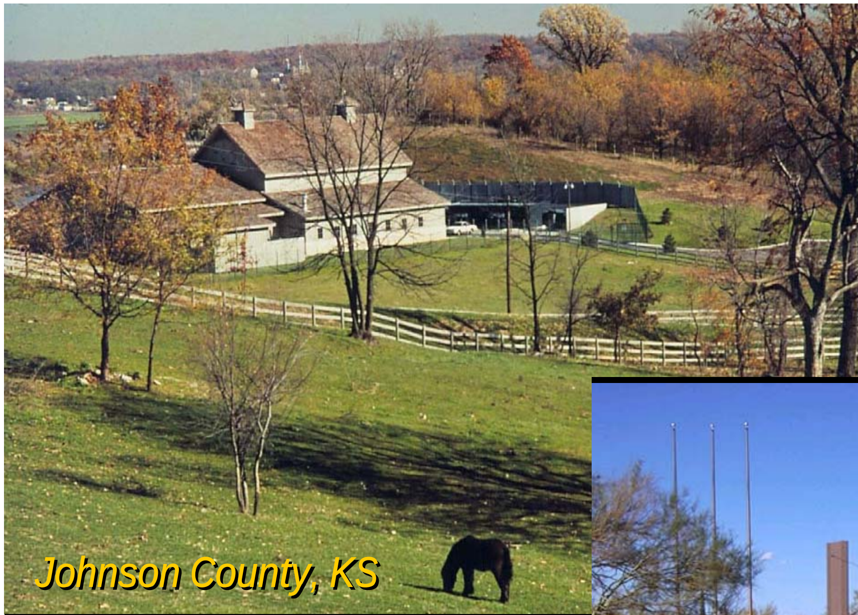


Covered Buildings and Basins

Activated Carbon

What is Site Aesthetics?

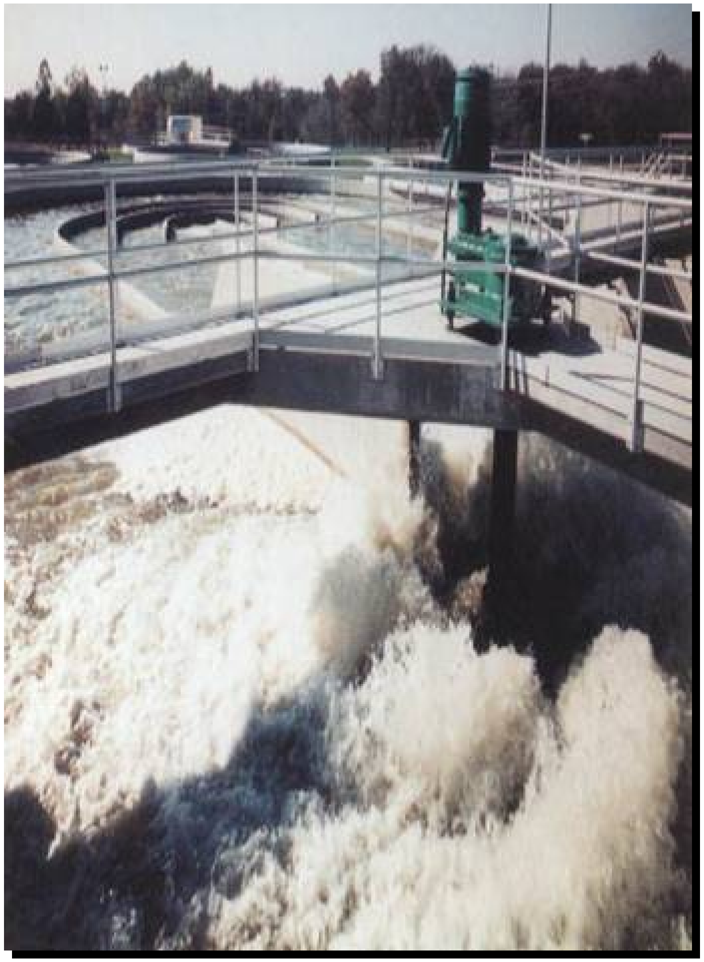
Possibilities are Limited by Imagination and Budget


Johnson County, KS


Topeka, KS

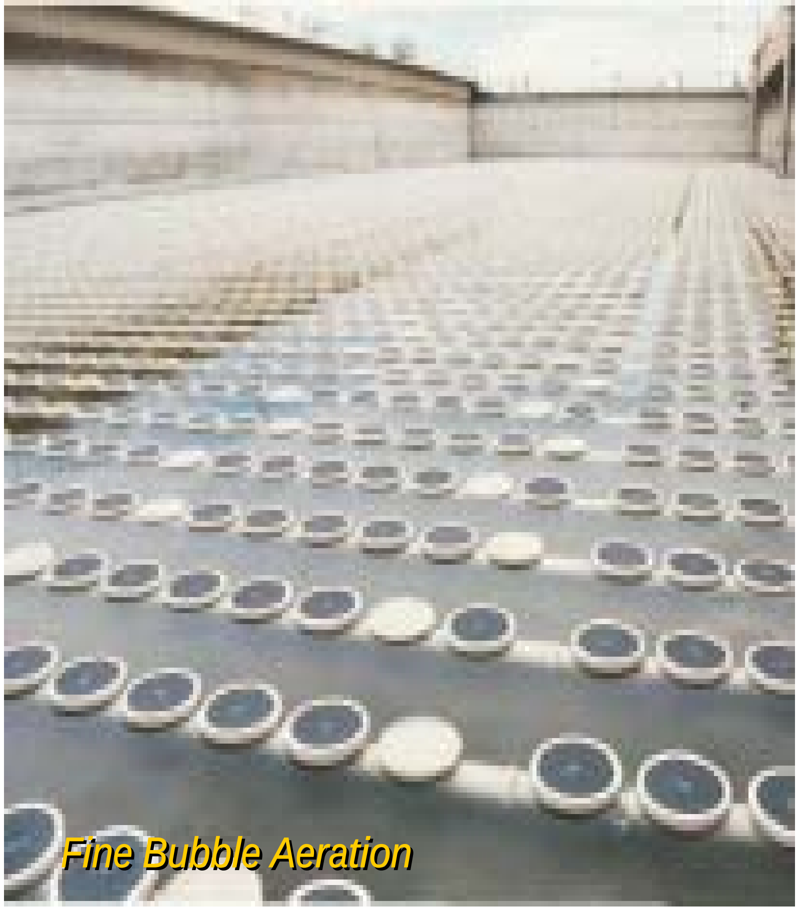

Scottsdale, AZ

Process Equipment Does Generate Noise



Methods of Reducing Noise


Filter Intake Silencer


Fine Bubble Aeration

Low Impact Lighting Solutions

- Screening
- Minimize site lighting
- Choosing appropriate lighting

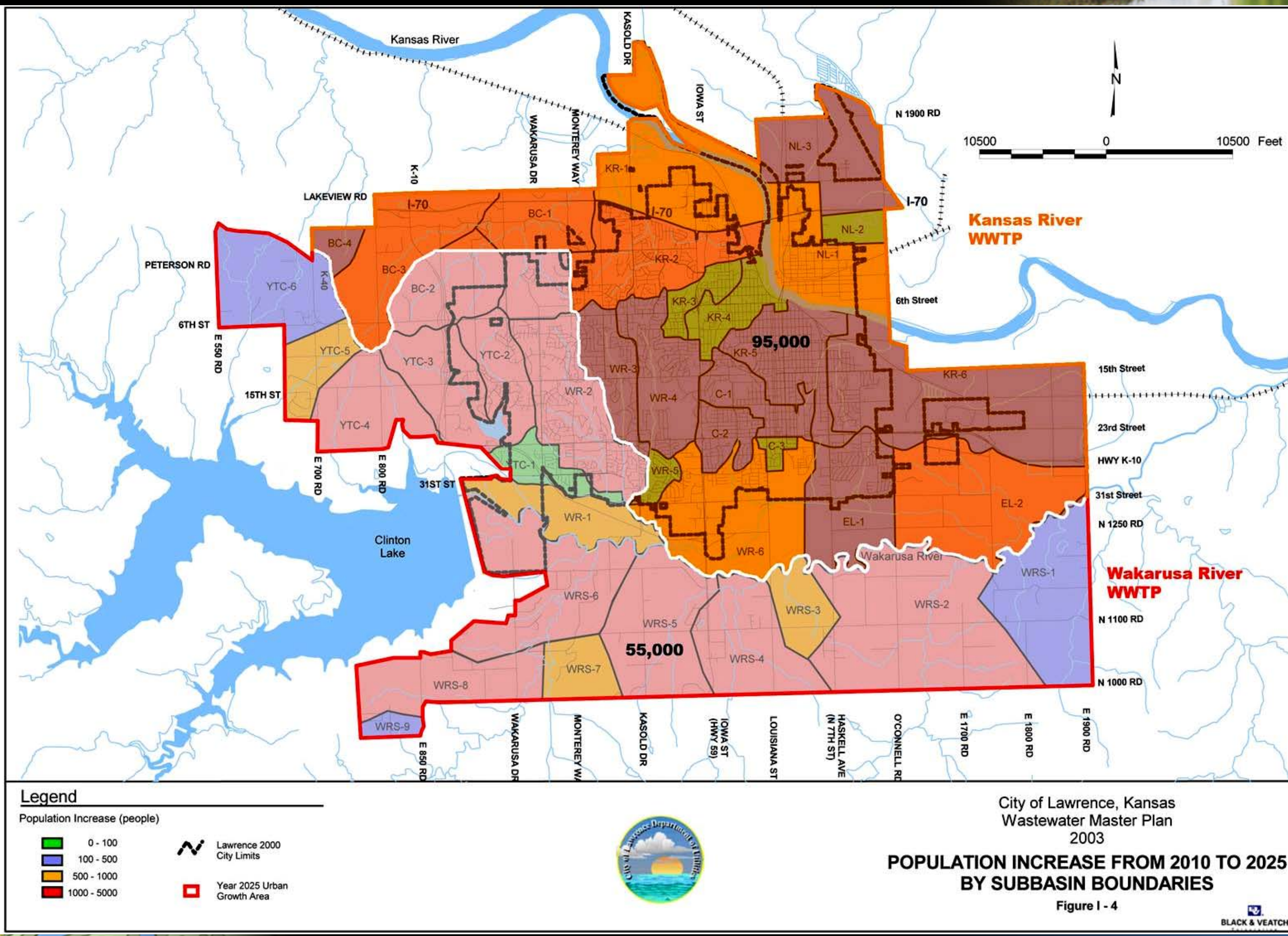
Property Value Impacts

- Decisions we make now will drive degrees of impacts

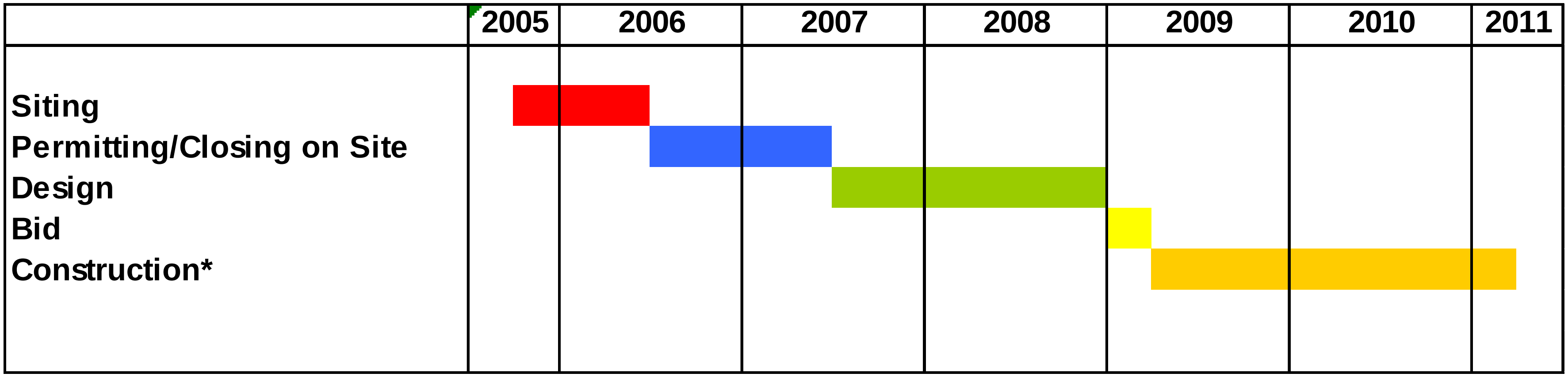
Why We Are Here Today

- Existing treatment plant nearing capacity
- Forecasted growth rate
- Master Plan recommendations
  - Wakarusa Water Reclamation Facility

Distribution of Flow to Wakarusa and Kansas River WWTPs



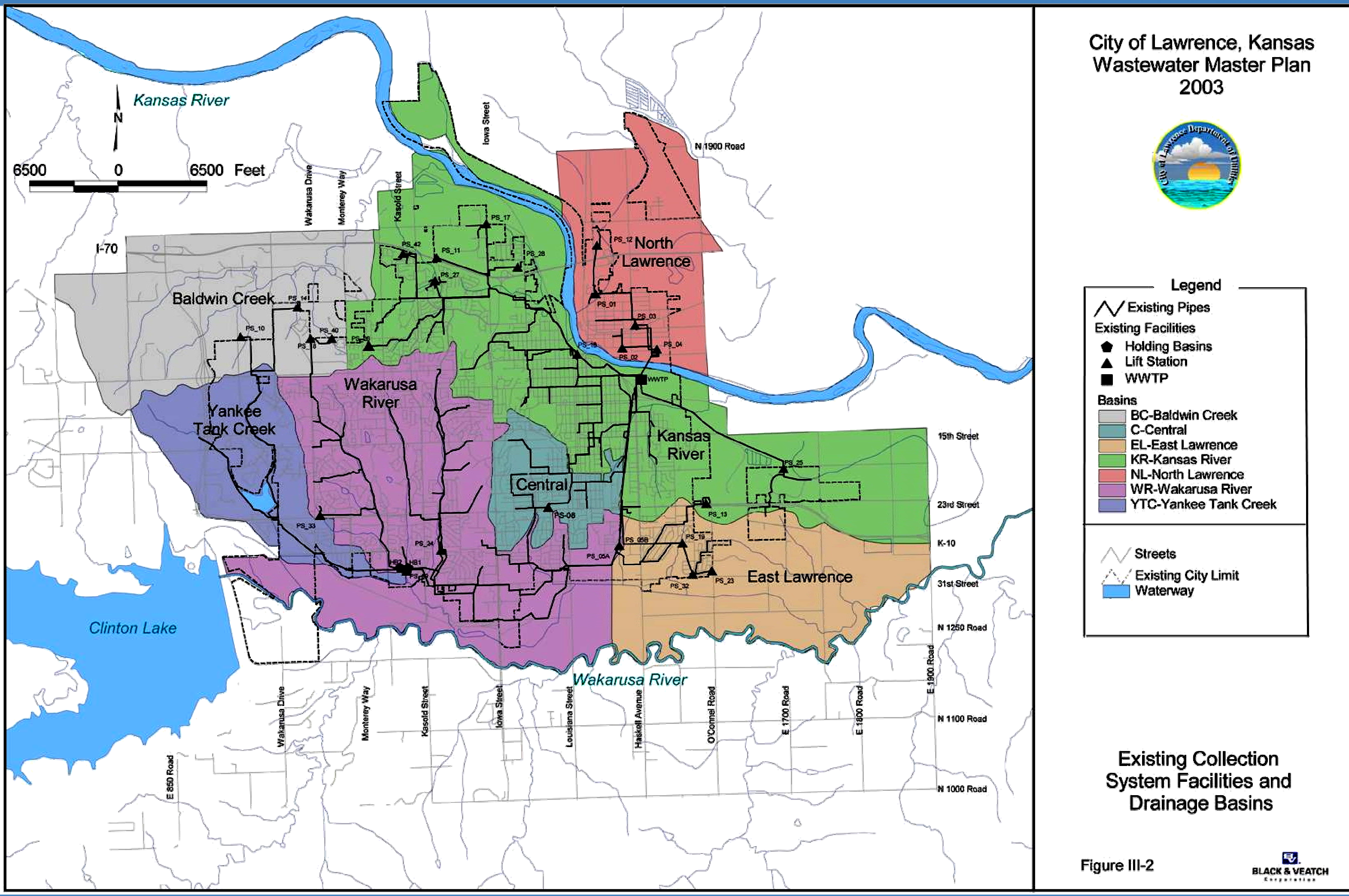
Wakarusa Water Reclamation Facility Timeline



* Construction schedule assumes conventional Design-Bid-Build approach

- Schedule compression required to have facility complete by 2011
  - Site acquisition time reduction
  - Start preliminary design early
  - Consider design/build

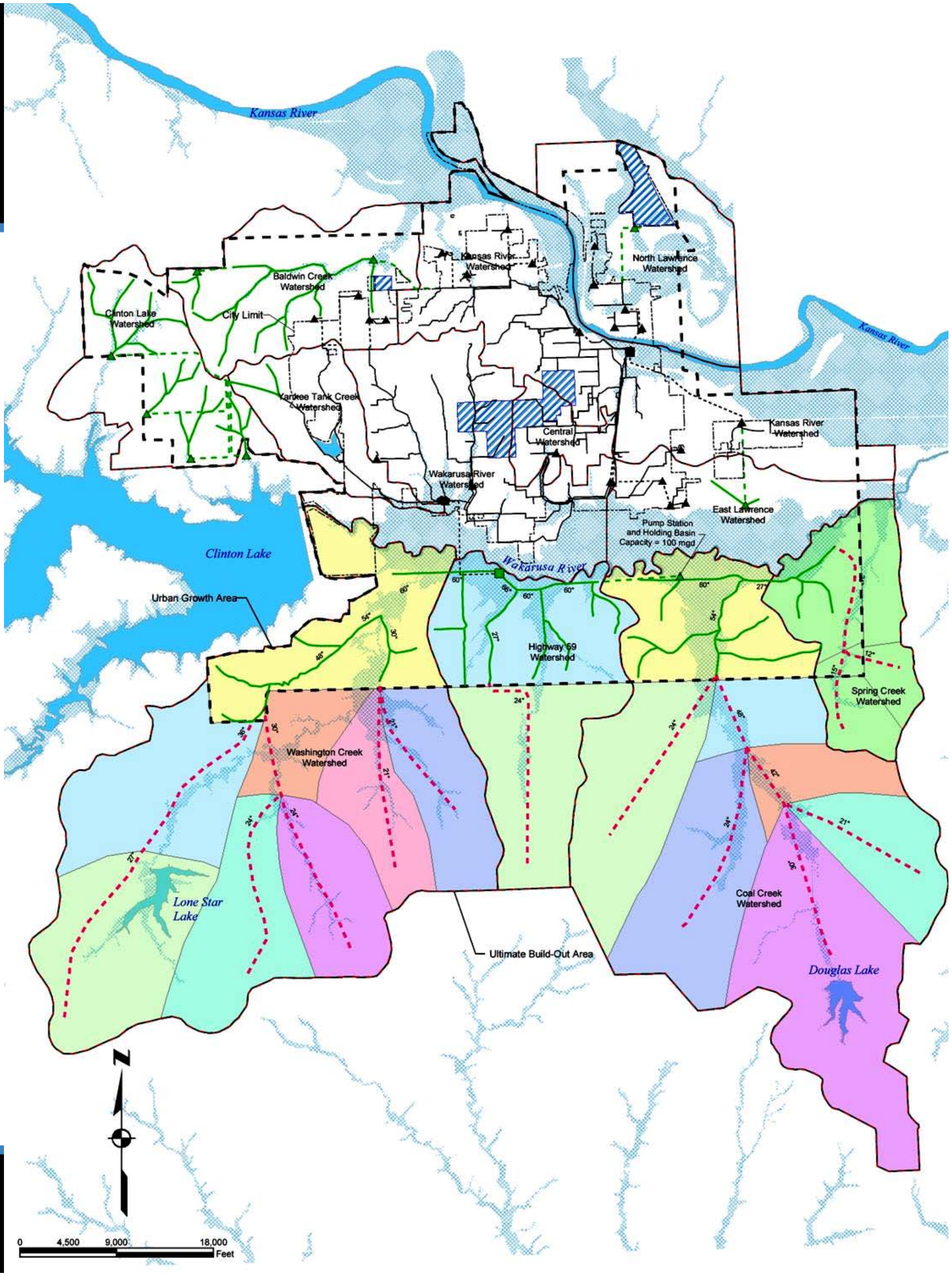
Lawrence Collection System and Treatment Plant



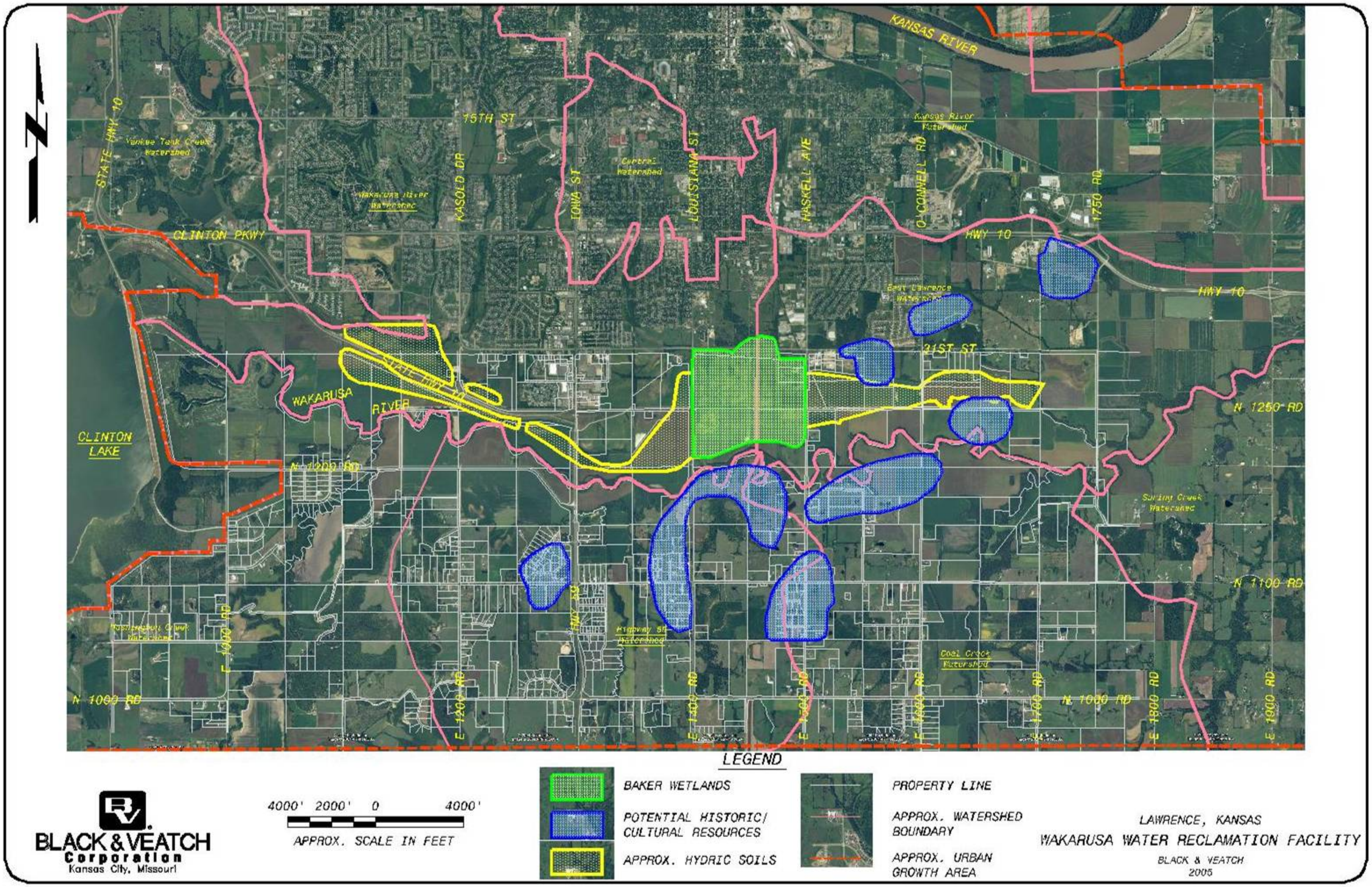
Public Meeting No. 1

BLACK & VEATCH
building a world of difference™

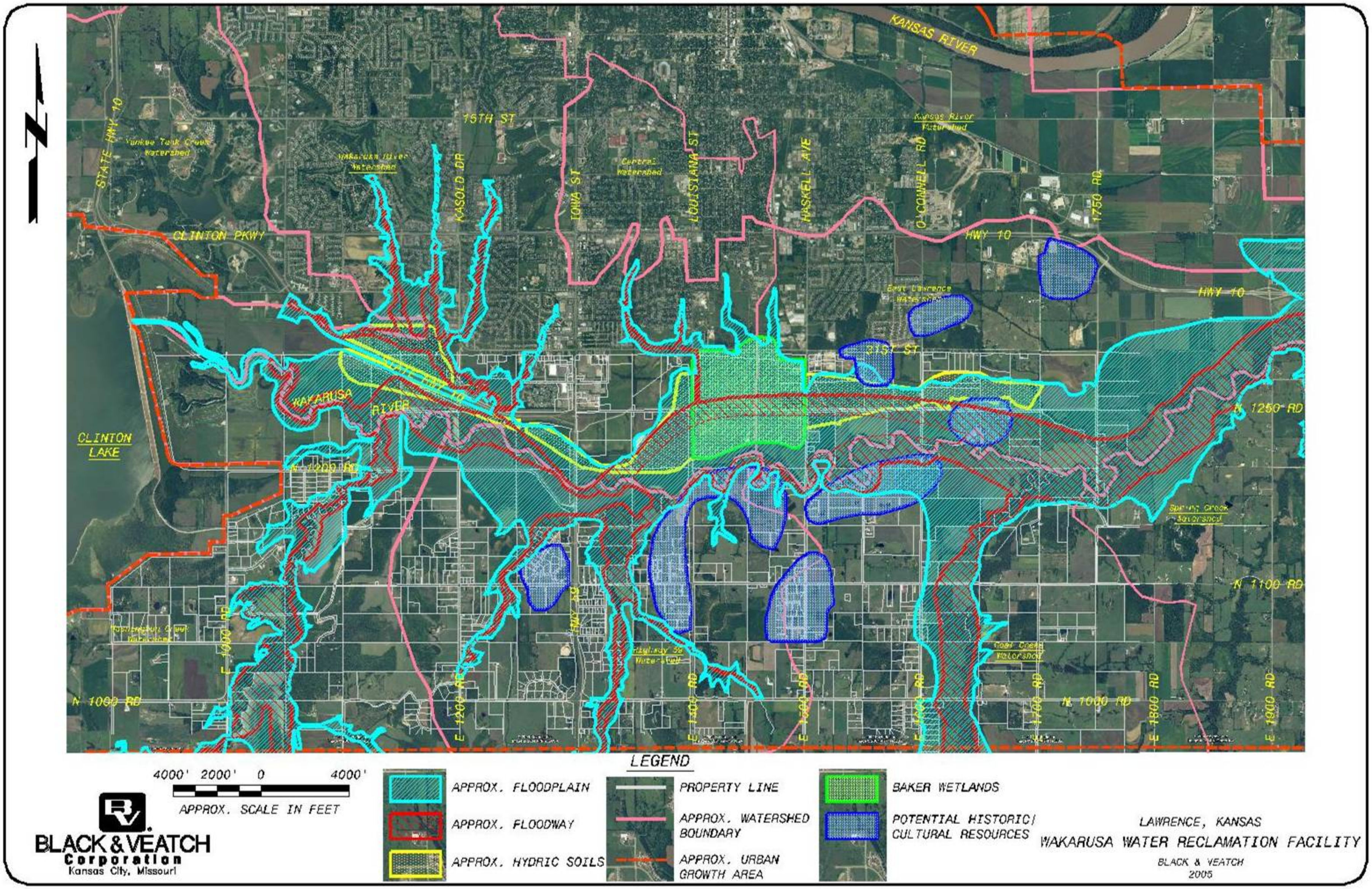
Vision for Ultimate Build-out



Wetlands and Cultural/Historical Considerations



Engineering Issues for Consideration



Public Input into Criteria

- Public acceptability factors
- Site utilization
- Appearance

Stakeholders' participation is vital

Stakeholder Interviews in Progress

- Purpose – Provide background information on which issues are most important to the public
- Range of perspectives sought
  - From Chamber of Commerce to Sierra Club
  - From individual property owners to university representatives
- Status
  - 27 Interviews requested
  - 24 Interviews accepted
  - 18 Interviews conducted thus far

Peer Group

- **Dr. Robert Kadlec**
  - Renowned expert in wetland treatment
- **Dr. Ross McKinney**
  - Professor Emeritus, University of Kansas
  - Specialized in wastewater treatment
- **Mr. John Metzler**
  - Currently Chief Engineer for Johnson County Wastewater
  - Operates three major wastewater treatment facilities within heavy residential areas
  - Former regulatory official at the Kansas Department of Health and Environment.
- **Mr. Charlie Stryker**
  - President of CAS Construction
  - Expertise in project scheduling and constructability
- **Mr. Joe Zoba**
  - Chief Executive Officer of Yucaipa Valley Water District, California
  - Holds MPA, which shapes the vision of his utility growth plans

Wakarusa Water Reclamation Facility Study Process

- Study to run through mid-2006

PAC Involvement	*Public-at-large*
PAC Introductory Meeting Overview	Public Meeting No. 1 Overview
Workshop No. 1 Criteria determination	Public Meeting No. 2 Discuss criteria
Workshop No. 2 Apply Criteria to Areas	Public Meeting No. 3 Review Criteria Application
Workshop No. 3 Detailed Criteria Application	Public Meeting No. 4 Final Results

Wakarusa Water Reclamation Facility
Public Introductory Meeting

Questions and Answers

HNTB

PBA
PATTI BANKS ASSOCIATES

BLACK & VEATCH
building a world of difference™

ENERGY WATER INFORMATION GOVERNMENT

BARTLETT & WEST
ENGINEERS
SERVICE. THE BARTLETT & WEST WAY.

Group Feedback

- Written Survey
- Open House

  8:15 to 8:30 pm
- Next Steps

MEETING MINUTES

Project: Wakarusa WRF **No.** P-05038
Date: **November 3, 2005**

Wakarusa WRF Public Open House #1

Attendance:

Community residents, representatives from the Public Advisory Committee, City Staff, and Consultant Team were in attendance at the meeting held at South Junior High School from 7:00 p.m. to 8:30 p.m.

Introductions and Project Team:

- Debbie Van Saun (Assistant City Manger) opened the meeting and introduced Patti Banks (Patti Banks Associates) who introduced the City Staff, Public Advisory Committee, and Consultant Team as outlined below.

City Staff

- End user of the Wakarusa Water Reclamation Facility
  - Dave Wagner, Assistant Director Wastewater
  - Philip Ciesielski, Utilities Engineer
  - Mark Hegemann, Wastewater Treatment Manager
  - Jeanette Klamm, Residuals Coordinator

Public Advisory Committee

- Conduit for public input and engagement through the evaluation process
  - Mr. Tom Bracciano, Lawrence Public Schools – Facilities and Operations Planning Division Director
  - Mr. Warren Corman, University of Kansas – Business and Financial Planning, University Architect
  - Mr. Rod Geisler, Kansas Department of Health and Environment – Bureau of Water Chief, Municipal Programs
  - Mr. John Craft, Neighbor to Kaw Wastewater Treatment Plan
  - Ms. Lavern Squier, Lawrence Chamber of Commerce, President and CEO
  - Mr. Michael Campbell, Kansas Sierra Club (Wakarusa Group), Chair
  - Ms. Mary Lynn Stuart, Lawrence Preservation Alliance, Secretary
  - Mr. Michael Caron, Save the Wetlands, President
  - Ms. Carrie Lindsey, League of Woman Voters – Lawrence/Douglas County, President
  - Mr. Ross Marshall, Kansas City Area Historic Trails Association, Secretary
  - Ms. Alison Reber, Kaw Valley Heritage Alliance – Kansas StreamLink Program, Executive Director
  - Ms. Bobbie Flory, Lawrence Home Builders Association, Executive Director
  - Ms. Laura Calwell, Kansas Riverkeepers – Friends of the Kaw

Black and Veatch

- Technical Consultant for wastewater collection and treatment
  - Mike Orth, Project Director
  - John Keller, Project Manager
  - Cindy Wallis-Lage, Process Department Head
  - Page Surbaugh, Design Engineer

<u>Patti Banks Associates</u>

- Outreach coordination
  - Patti Banks
  - Lisa Briscoe

<u>Bartlett and West</u>

- Surveying
  - Joe Caldwell

<u>HNTB</u>

- Permitting
  - John Pasley
  - Jennifer Johnson

Wastewater 101:

- Cindy Wallis-Lage, Black & Veatch, provided a general overview of a typical wastewater collection system and the treatment process. Wallis-Lage described the differences between a wastewater treatment plant and a water reclamation facility. She noted that wastewater treatment plants treat collected wastewater while reclamation facilities treat collected wastewater and provide a beneficial reuse of a portion of the waste products and/or treat the effluent to a higher quality, depending upon the desired use. She also noted that the City has the opportunity to create an asset at the site by considering multi-use of the surrounding buffer area for the public's use.

<u>Typical Concerns</u>

- Wallis-Lage summarized Lawrence's current wastewater collection system and treatment plan. She reviewed the typical concerns associated with wastewater treatment and discussed associated typical solutions that may be considered including:
  - Generation of odors
  - Aesthetics
  - Noise
  - Plant and site lighting
  - Increased truck traffic
  - Disposal of residuals
  - Property value impacts

Project Overview:

<u>Why We Area Here Today</u>

- Mike Orth, Black & Veatch, provided a summary of the origin, rationale, and purpose of the Study. He specifically noted that the existing treatment plant is nearing capacity and can accommodate a population basis of approximately 100,000. The City's existing population is approximately 85,000. Based upon the growth projections utilized in the ***2003 Wastewater Master Plan***, it is anticipated that the 100,000 population basis will be reached around 2011. As a result of the current plant's capacity and the projected growth, the Master Plan recommends that the City develop the Wakarusa Water Reclamation Facility (WRF).

  - **Horizon 2020/Land Use**
    - ✓ The City's Comprehensive Plan and its growth recommendations for 2025 are the starting point for the Wakarusa WRF.
    - ✓ The Plan recommends that Lawrence plan for residential growth to the west and south.

- **2003 Wastewater Master Plan**
  - ✓ The Plan Recommends that a new wastewater facility be constructed that will discharge into the Wakarusa River.
  - ✓ The anticipated effluent limitations would be equal for the Kansas and Wakarusa Rivers based upon the nutrient levels for the rivers. This is a change from previous planning documents where more stringent limits were placed on the Wakarusa.
  - ✓ Constructing a Wakarusa WRF is more cost-effective than transporting all the flow and expanding the existing plant.

- **Growth Rate May Be Exceeding Population Projections**
  - ✓ The design population for the existing wastewater treatment plant is 100,000 people.
  - ✓ Lawrence's 2003 wastewater service area was originally expected to reach the design population around 2011.
  - ✓ There is a potential that the overall City growth is occurring at a faster rate, and more densely, than originally forecasted. This may require acceleration of the completion of the Wakarusa WRF project. Therefore, it is important to maintain the planned schedule and improve upon it where feasible.

Timeline

- Orth outlined a compressed schedule that involved reducing site acquisition time, starting preliminary designs early, and considering design build may be necessary to construct the Wakarusa WRF prior to 2011. A construction schedule that utilizes a traditional design/bid/build approach would entail:
  - 2005 – 2006: Siting
  - 2006 – 2007: Permitting/Closing on the site
  - 2007 – 2008: Design
  - Early 2009: Bid
  - 2009 – 2011: Construction

Study Area Considerations

- Orth noted that a vision for ultimate build-out should be created as a part of the Study. He stressed that no preconceived facility locations had been selected and that gravity flow should be accommodated to the extent possible. Important project constraints include:
  - Maximizing the use of the existing collection system
  - Wetlands, cultural, and historic locations
  - Engineering issues:
    - ✓ Floodway
    - ✓ Floodplain
    - ✓ Environmental permitting
    - ✓ Site geology
    - ✓ Site topography
    - ✓ Proximity to utilities
    - ✓ Proximity to roadways
    - ✓ Affordability within rate plan

Introduction to the Process:

Public Input into the Criteria for Selection

- Patti Banks stated that public input related to public acceptability factors, site utilization, compatibility with land uses, and appearance would be considered in the criteria for site selection of the water reclamation facility.

Stakeholder Interviews

- Banks said that community stakeholders are currently being interviewed and scheduled for interviews. The purpose of the stakeholder interview process is to provide background information on which issues are most important to the public. The interviews seek to gain a range of perspectives about the project and include individuals from the Chamber of Commerce to the Sierra Club and from individual property owners to University representatives. Thus far, twenty-seven interviews have been requested, twenty-four accepted, and eighteen conducted.

Peer Group Roles

- Banks explained the roles and qualifications of the Peer Group participants as follows:
    - **Dr. Robert Kadlec**
        - ✓ Renowned expert in wetland treatment
    - **Dr. Ross McKinney**
        - ✓ Professor Emeritus, University of Kansas
        - ✓ Specialized in wastewater treatment
    - **Mr. John Metzler**
        - ✓ Currently Chief Engineer for Johnson County Wastewater
        - ✓ Operates three major wastewater treatment facilities within heavy residential areas
        - ✓ Former regulatory official at the Kansas Department of Health and Environment
    - **Mr. Charlie Stryker**
        - ✓ President of CAS Construction
        - ✓ Expertise in project scheduling and constructability
    - **Mr. Joe Zoba**
        - ✓ Chief Executive Officer of Yucaipa Valley Water District, Columbia
        - ✓ Holds MPA, which shapes the vision of his utility growth plans

Description of the Process

- Banks said that it was anticipated that the study would run through mid-2006 and that during that period there would be PAC meetings and public meetings as follows:

PAC Introductory Meeting Overview	Public Meeting No. 1 Overview
Workshop No. 1 Criteria determination	Public Meeting No. 2 Discuss criteria
Workshop No. 2 Apply Criteria to Areas	Public Meeting No. 3 Review Criteria Application
Workshop No. 3 Detailed Criteria Application	Public Meeting No. 4 Final Results

Questions and Answers:

- Orth opened the meeting for questions and answers from the public. Participants commented as follows:
  - The use of wetlands should be explained in terms of expense and site size. Will it increase the size of the facility?
  - Will there be an impact on wildlife.
  - Will analysis be completed for when things fail in relation to security issues?
  - Can you examples of how buffer areas are used in other communities?
  - What can grey water be used for and at what treatment level?
  - Are reclamation sites an opportunity for naming (donation)?
  - Are environmental studies a part of this process?
  - What plans are required, in what timeframe and what are the costs associated?
  - Explain the reports for sites A and B.
  - Have you identified a site?
  - How far north and south of the Wakarusa River will you look?
  - Energy efficiency is important. If the PAC were to agree that energy efficiency were important would that impact site location?
  - Is there access to data related to current design solutions in other places?
  - Has water conservation worked to help reduce flows, such as credits for replacing toilets?
  - How do you control odors?
  - What are hydraulic soils?
  - How do you determine who is interviewed?
  - Did we have this discussion ten years ago with the same projections?
  - What does the $80 million pay for?
  - What is the date, time and location of the next pubic meeting?

Open House:

- Orth explained that the remainder of the meeting would be an open house and encouraged participants to complete a project survey before leaving the meeting. He advised that next public meeting would be advertised through local media channels and posted on the City's project website.

Constructed Wetlands: State of the Science

Engineered

Plant, Substrate and Water Systems

for

Water Quality Improvement

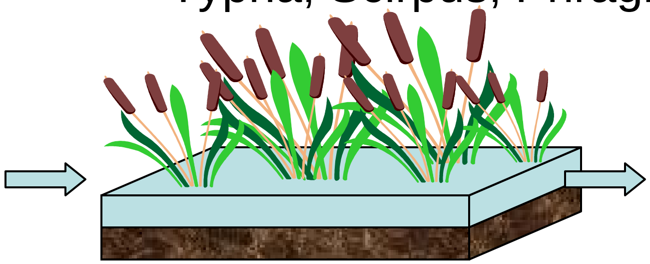
Agenda

- Types of wetland treatment systems
- Examples
- How wetland treatment works
- Levels of treatment
- Design requirements
- Operation and maintenance considerations
- Questions

Principal Types and Characteristics

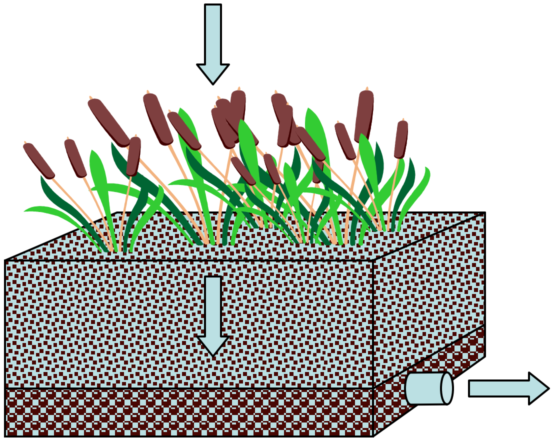
Free Water Surface:

30 - 80 cm (12 – 32 in) deep water
0.02 - 75 cm/d (0.007 – 30 in/day)
0 - 65° north
Typha, Scirpus, Phragmites



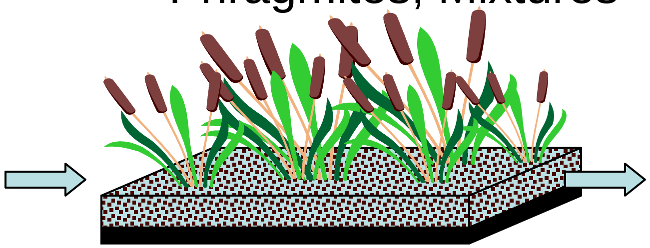
Vertical Subsurface Flow:

80 - 120 cm (32 to 47 in) deep gravel
5 - 25 cm/d (2 to 10 in/day)
Phragmites, Typha



Horizontal Subsurface Flow:

30 - 80 cm (12 – 32 in) deep gravel
5 - 75 cm/d (2 to 30 in/day)
0 - 65° north
Phragmites, Mixtures

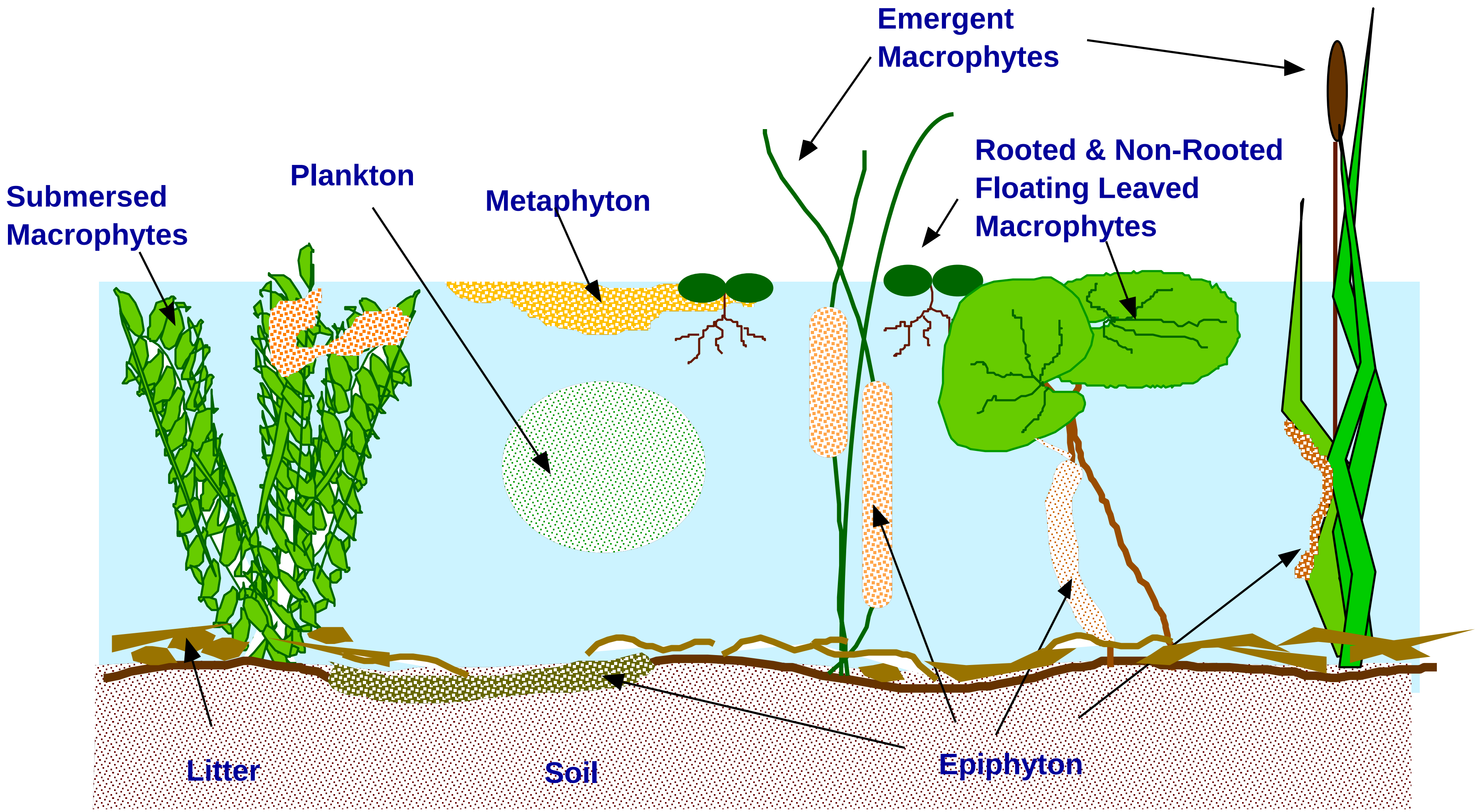


Examples of Wetland Systems

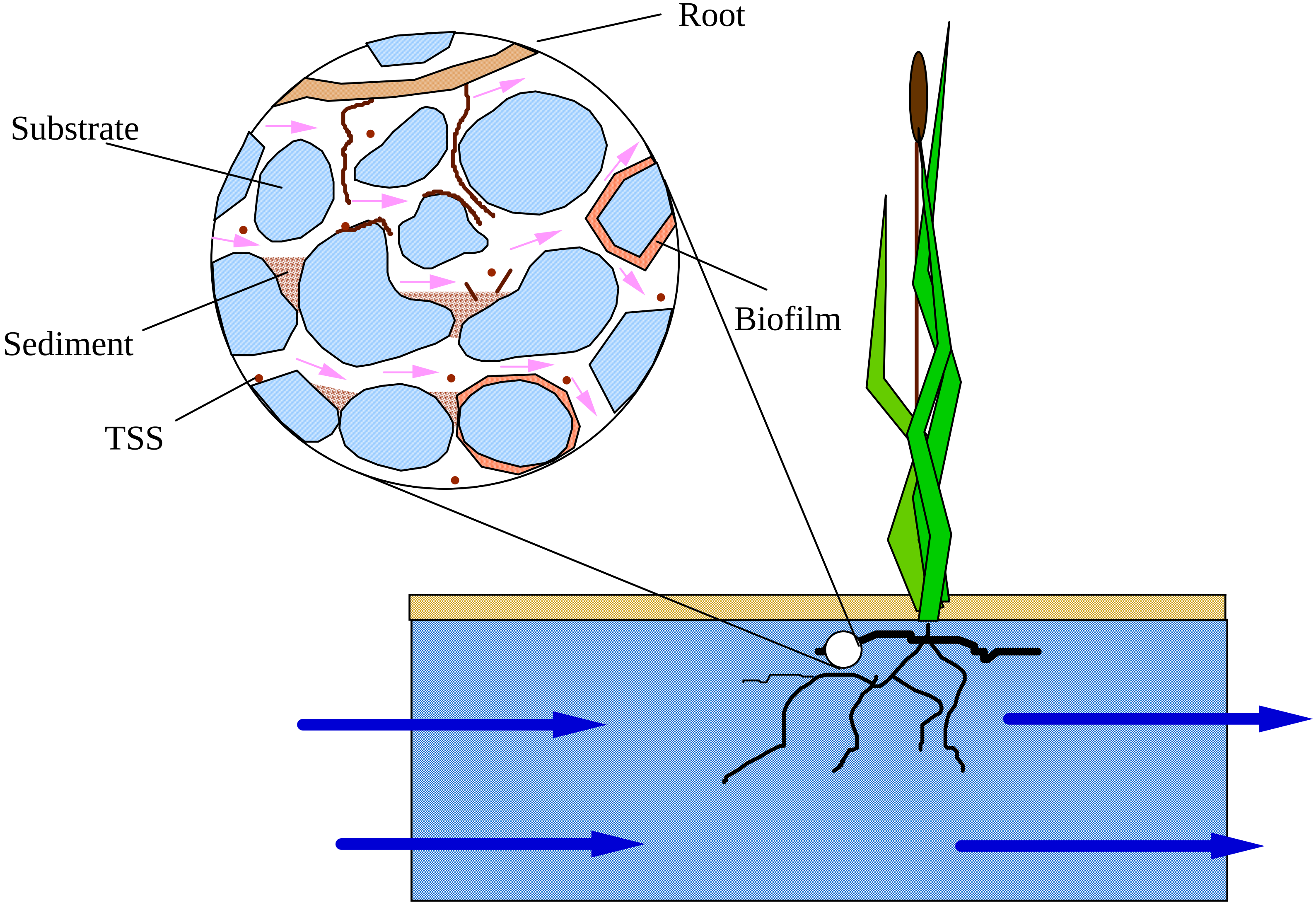
- Southern Portugal
- Single family on-site
- Goal: reuse
- Septic tank effluent, Subsurface Flow

- Southern Florida Free Water Surface
- Landscape scale
- Goal: Everglades protection
- Agricultural field runoff

Structure of a Free Water Surface Wetland



Structure of a Subsurface Wetland

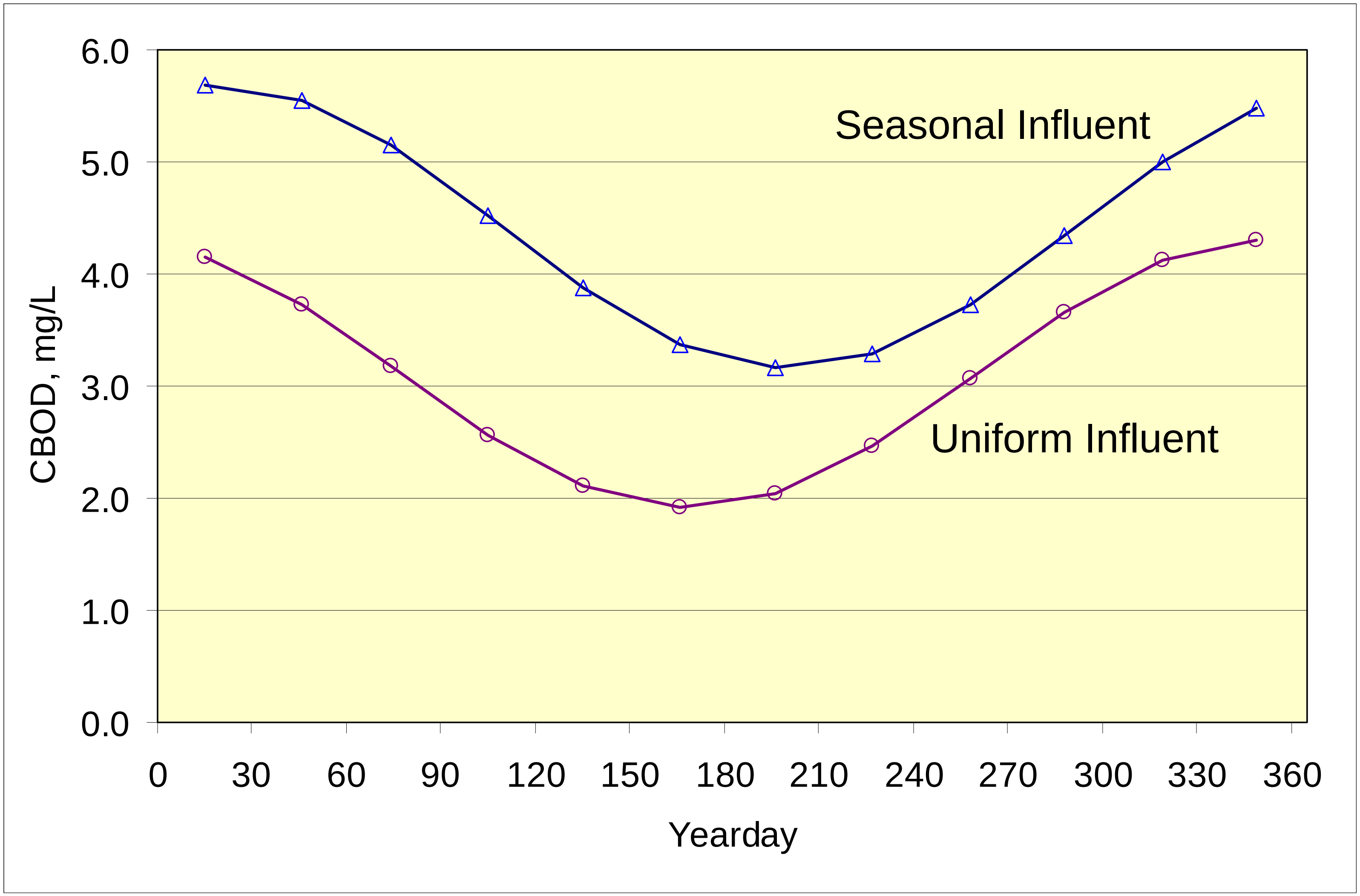


SSCW6

Pollutant Removals

- Dependent on a number of factors including
  - Influent loadings
  - Air/water temperature
  - Flows
  - Other factors

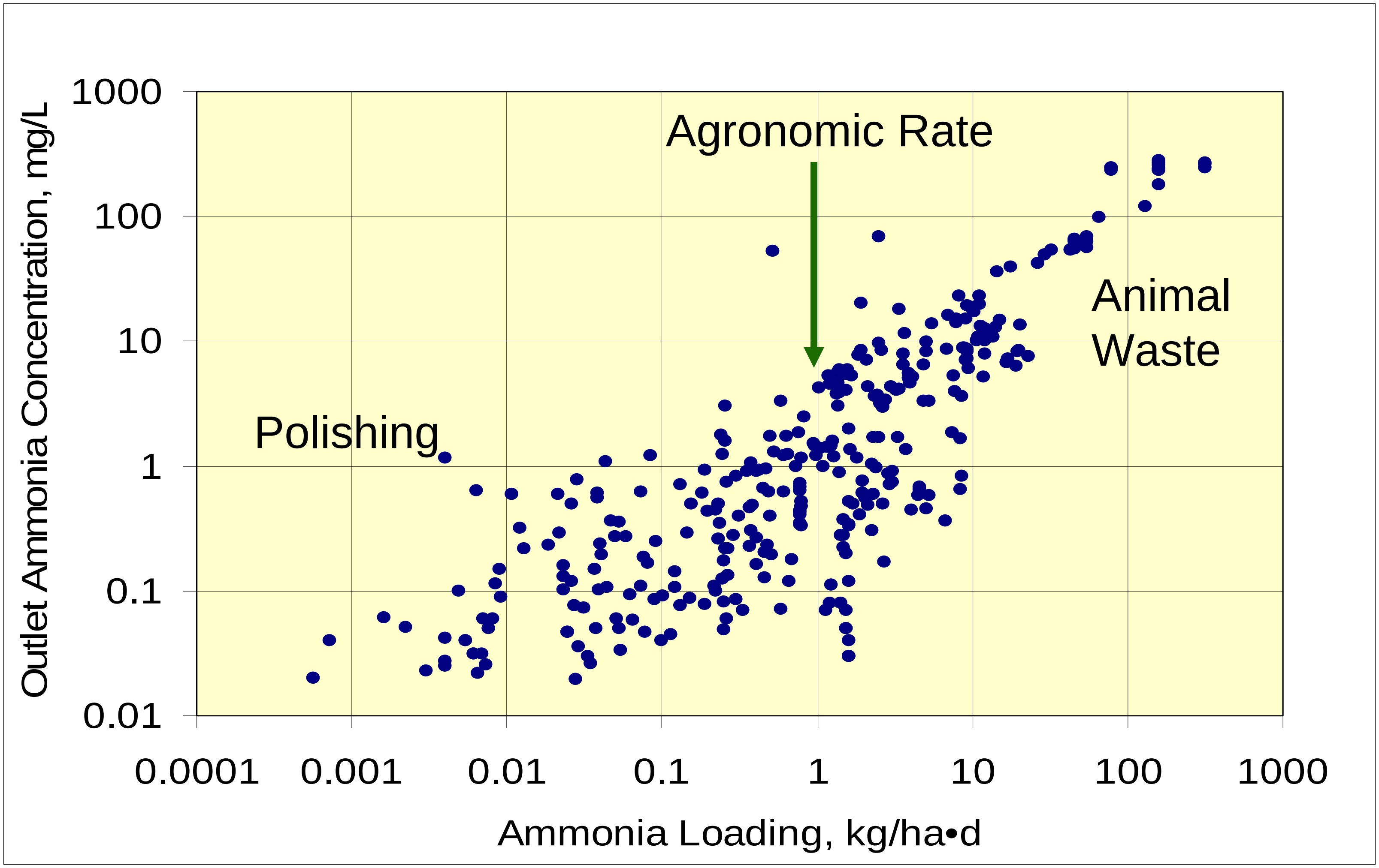
Seasonal Wetland Effluent BOD



Suspended Solids

	TSS In	TSS Out
FWS		
Listowel, ONT	111	8
Fort Deposit, AL	91	13
Augusta, GA	19	9
Columbia, MO	13	8
Lakeland, FL	5.7	2.9

FWS Ammonia Removal



1 kg/ha-day = 0.9 pounds/acre-day)

Design Requirement for Wetlands

- Flow rate
- Influent wastewater loading
- Effluent requirements
- Temperature
- Seasons
- Vegetation
- Access

Operation and Maintenance and Startup Requirements

- What are they?
- Are there issues with animals?
- What should the City expect?
- What is operational changes are required during wet or cold weather?
- Vegetation type and growth?
- After the wetland is built, is it ready to be used on Day 1?

Human Use

Ancillary Benefits

Wildlife Use

Summary

- The fifty year history of engineered treatment wetlands has been marked by exponential growth, in scientific knowledge, numbers of systems, and types of applications.
- Constructed wetlands are practical, economical, and user-friendly.
- Constructed wetlands are not a stand-alone technology.
- Constructed wetlands often require large land areas, are subject to natural stochastic behavior, and have few adjustable controls.

Constructed Wetlands: Wakarusa Considerations

Supporting Information and Projects

Conceptual Reference Alternatives

BIG Constructed Wetlands

	Acres	Functions
Beaumont, TX	650	Ammonia reduction, public use
Vorup Enge, Denmark	295	Non-point nitrate , public use
Columbia, MO	131	BOD & TSS reduction
Calgary, Alberta	370	Urban stormwater (in design)
Phoenix, AZ	420	Green space, polishing (in design)
Orlando Easterly, FL	1220	Polishing
Prado, CA	150	Nitrate control
Everglades, FL (six)	800 - 14,000	Phosphorus control for agricultural runoff

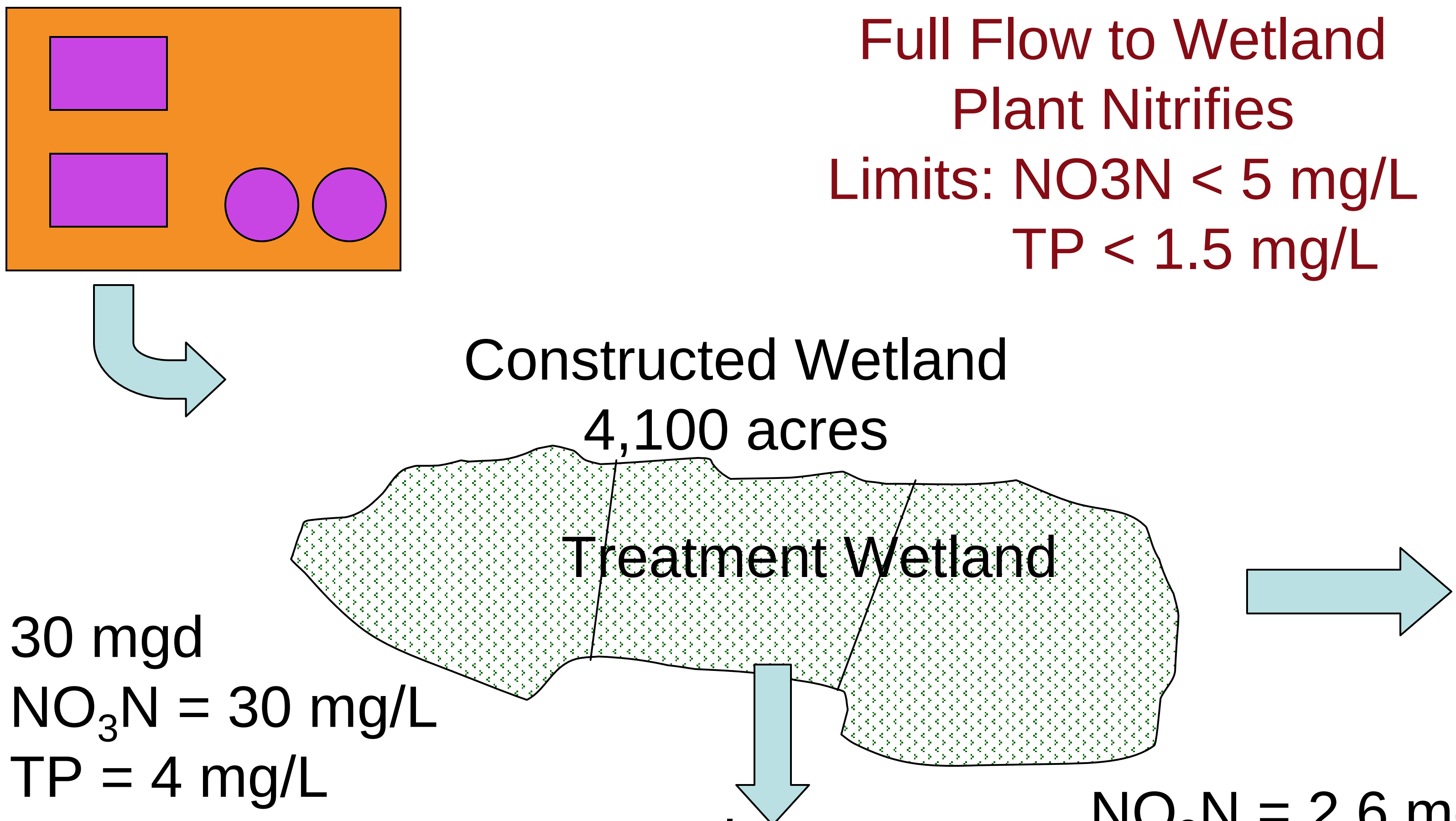
Wetland Alternatives (Preliminary)

- Treatment after mechanical plant to achieve TN and TP removal
- Set area…what additional treatment can be achieved
- Side stream treatment…smaller flow

ALTERNATIVE 1

Denitrification in Wetland
Full Flow to Wetland
Plant Nitrifies
Limits: NO3N < 5 mg/L
TP < 1.5 mg/L

Mechanical Plant



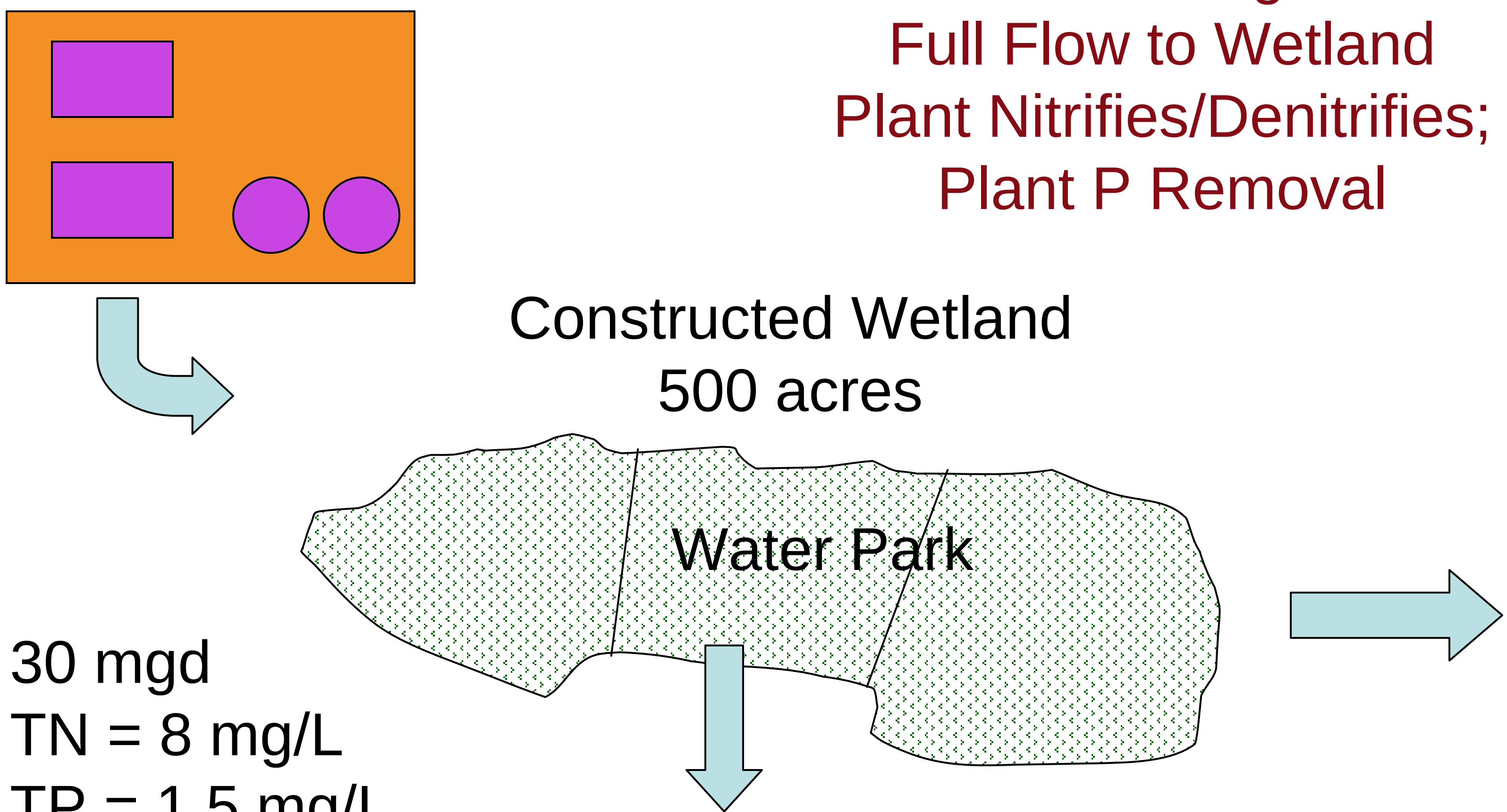
SSCW18

ALTERNATIVE 2

Polishing
Full Flow to Wetland
Plant Nitrifies/Denitrifies;
Plant P Removal

Mechanical Plant

Constructed Wetland
500 acres



30 mgd
TN = 8 mg/L
TP = 1.5 mg/L

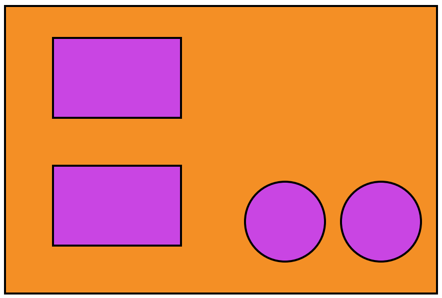
Removal
138 mt N
32 mt P

TN = 4.7 mg/L
TP = 0.7 mg/L

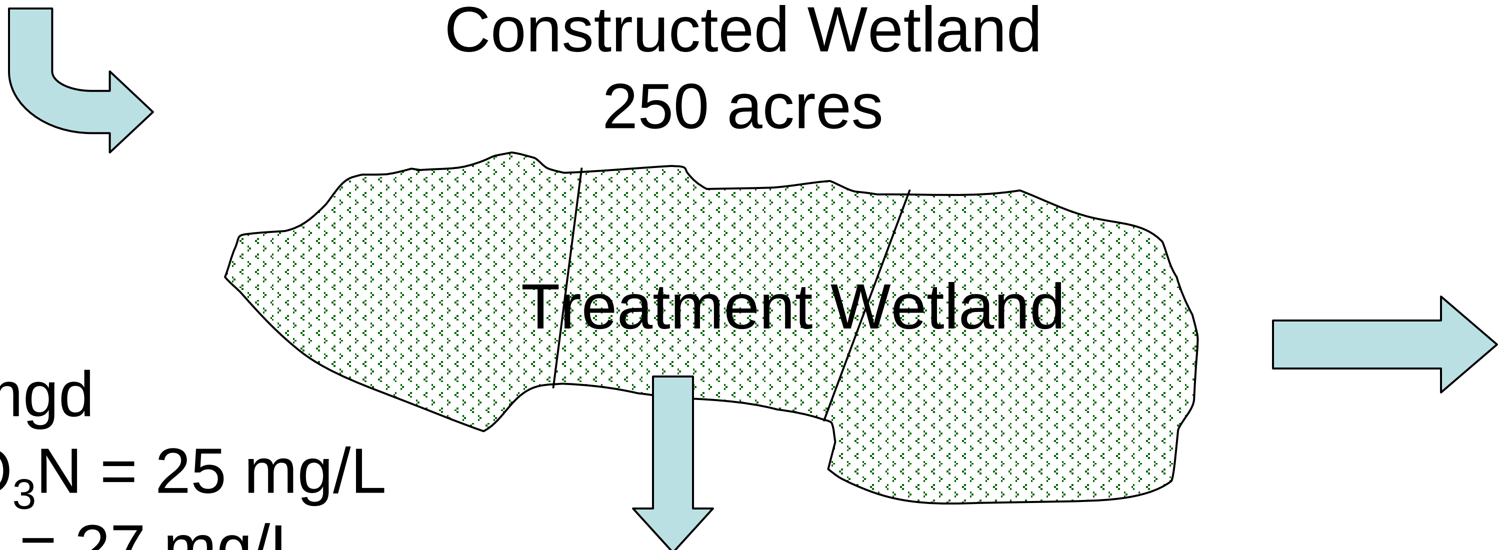
ALTERNATIVE 3

Sidestream to Wetland
Plant Nitrifies
Limits: NO3N < 5 mg/L
TN < 8 mg/L

Mechanical Plant



Constructed Wetland
250 acres



3 mgd
NO_3N = 25 mg/L
TN = 27 mg/L
TP = 1.5 mg/L

Removal
94 mt N
5.8 mt P

NO_3N = 2.4 mg/L
TN = 4.4 mg/L
TP = 0.09 mg/L

SSCW20

Questions

MEETING MINUTES

Wakarusa WRF Wetlands Seminar

Introduction:

On behalf of the City of Lawrence, Dr. Robert Kadlec, Professor Emeritus of Chemical Engineering, University of Michigan conducted a wetlands seminar in the City Hall, City Commission Chambers on January 18, 2006 from 3:00 to 4:00 PM. Kadlec discussed wetland treatment systems, factors that affect their design and operation, and how they may be incorporated within the Wakarusa Water Reclamation Facility. He is a Principal with Wetland Management Services in Chelsea, Michigan, and his professional career has primarily been concerned with the implementation of wetland systems for water pollution control. He has also participated in the design of over 100 wetland treatment systems, and conducted feasibility studies for many others, and co-authored *Treatment Wetlands,* which is generally received as the guide to planning, design, construction, and operation of wetlands used for water quality control.

Attendance:

- Nearly 30 representatives from the Lawrence community, Public Advisory Committee, City Staff, and Consultant Team were in attendance at the meeting held in City Hall, Commission Chambers. (See attached sign-in sheet).

Agenda:

- Kadlec indicated that as a part of the seminar he would discuss the items listed below and would be open to questions afterwards.
    - Type of wetland treatment systems
    - Examples
    - How wetland treatment works
    - Levels of treatment
    - Design requirements
    - Operation and maintenance considerations
    - Constructed Wetlands

Principle Wetland Types and Characteristics:

- Kadlec outlined principle wetland types and characteristics including free water surface and vertical and horizontal sub-surface flows.

Examples of Wetland Systems:

- Kadlec discussed example wetland systems such as:
    - Southern Portugal
    - Southern Florida free water surface

Wetland Structures: Free Water Surface and Sub-surface

- Kadlec explained free water surface and sub-surface wetland structures in terms of their components as follows:
    - Free water surface
        - ✓ Litter
        - ✓ Soil
        - ✓ Epiphyton
        - ✓ Submersed macrophytes
        - ✓ Plankton
        - ✓ Metaphyton

- ✓ Emergent macrophytes
- ✓ Rooted and non-rooted floating leaved macrophytes

- o Subsurface
  - ✓ Substrate
  - ✓ Sediment
  - ✓ TSS
  - ✓ Root
  - ✓ Biofilm

Pollutant Removals:

- Kadlec said that pollutant removal was dependent upon a number of factors including: influent loadings, air and water temperatures, flows, and other elements.

Seasonal Wetland Effluent BOD:

- Dr. Kadlec explained that seasonal changes impact the effectiveness of the wetland treatment for a given wetland acreage.

Suspended Solids:

- Kadlec used the table below to illustrate that wetland treatment system can be very effective in removing suspended solids.

FWS	TSS In	TSS Out
Listowel, ONT	111	8
Fox Deposit, AL	91	13
Augusta, GA	19	9
Columbia, MO	13	8
Lakeland, FL	5.7	2.9

FWS Ammonia Removal:

- Kadlec explained that there is a great deal of data available to model the ammonia removal from various types of wetland systems. Wetlands may be designed to control nutrients, including ammonia and phosphorus.

Design Requirements for Wetlands:

- Kadlec said that wetland design requirements include the following parameters:
  - o Flow rate
  - o Influent wastewater loading
  - o Effluent requirements
  - o Temperature
  - o Seasons
  - o Vegetation
  - o Access

Operation, Maintenance, and Startup Requirements:

- Kadlec noted that treatment does not necessarily result in lower first cost but are usually much less to run. He answered key questions about wetland requirements for operation, maintenance, and startup that included the following:
  - What are they?

    They typically involve plant maintenance and can include bug control programs.

  - Are there issues with animals?

    Sometimes significant issues can arise when beavers block the inlet or outlet structures. If the wetland is inhabited by muskrats, you may need to control them to avoid damages to liners and embankments. You may also have to control mosquitoes and other bugs based upon seasonal conditions.

  - What should the City expect?

    Maintenance is required to control plant growth and maintain inlet/outlet structures free of plant growth. Natural disasters such as flooding, drought, etc. may cause significant damage to the wetlands and may even require replanting.

  - What operational changes are required during wet or cold weather?

    If properly designed for the seasonal fluctuations in temperature, there should not be significant O&M implications. If it gets cold enough to freeze the entire water column, the wetland will not provide any level of treatment.

  - Vegetation type and growth?

    Design requirements primarily focus on how much vegetation is provided and not the type. The plant selection depends upon your budget. Traditionally, native plants will be the most robust under differing climate and effluent conditions. Wetlands may be designed and left to become naturally planted or they may be manually planted with specific species as desired. The manual planting may establish the wetlands somewhat quicker (2 years versus 3 years), but does not guarantee plant survival and incurs additional expense over natural planting.

  - After the wetland is built, is it ready to be used on Day 1?

    No, it will likely require at least two growing seasons to allow the plants to grow (green stuff) and die (brown stuff) for the wetland to become established.

Ancillary Benefits:

- Kadlec said that ancillary wetland benefits include human and wildlife uses, such as trails, bird watching, and provision of additional habitats.

Summary:

- Kadlec summarized the information presented thus far in the seminar by stating that the 50-year history of engineered treatment wetlands has been marked by exponential growth in scientific knowledge, number of systems, and types of applications. Constructed wetlands are practical, economical, and user-friendly – provided that the user is friendly in return. However, they are not a stand-alone technology. Constructed wetlands often require large land areas and are subject to natural stochastic behavior, and have few adjustable controls. Performance can rise and fall based on a variety of uncontrollable factors.

Constructed Wetlands: Wakarusa Considerations

- Kadlec outlined constructed wetlands in terms of examples of existing big projects and conceptual reference alternatives as follows:

  Example Existing Big Projects

	Acres	Functions
Beaumont, TX	650	Ammonia reduction, public use
Vorup Enge, Denmark	295	Non-point nitrate, public use
Columbia, MO	131	BOD and TSS reduction
Calgary, Alberta	370	Urban stormwater (in design)
Phoenix, AZ	420	Green space, polishing (in design)
Orlando Easterly, FL	1,220	Polishing
Prado, CA	150	Nitrate control
Everglades, FL (six)	800 – 14,000	Phosphorous control for agricultural runoff

  - Columbia, MO Plant: Dr. Kadlec noted that he designed the Columbia, Missouri wetland treatment system. He said that it was now an aging facility with permit issues, such as secondary treatment measures that do not meet standards, although the BOD and total suspended solids (TSS) requirements are being met. He said that communities may not want to remove everything depending on what is required of the receiving waters. For example, if they are for irrigation, communities may want to leave some nitrogen and phosphorus in the water to fertilize the irrigated land.

Alternatives:

  - Preliminary Wetland Alternatives include: treatment of mechanical plants to achieve total nitrogen (TN) and total phosphorous (TP) removal, set area (what additional treatment can be achieved), and side stream treatment (smaller flow). Kadlec noted that pre-existing wetlands can be mixed, although they may likely be destroyed. Mixing wetlands gets them out of balance because this allows cattails and muskrats to thrive on higher level nutrients in the system.

    - Alternative 1 involves wetland denitrification downstream of a treatment plant, which requires 6,000+ acres for full de-nitrification; the system is sized for winter performance.
    - Alternative 2 entails polishing, full flow to wetlands, upstream treatment plant nitrifies/denitrifies.
    - Alternative 3 involves sending a side stream to the wetland, upstream treatment plant nitrifies.

Questions:

- Kadlec opened the seminar to participants' comments and was asked the following questions:
  - Nitrogen and phosphorous are key fertilizer elements – can we capitalize from this?
    - Elemental nitrogen and phosphorous are too expensive to remove from water and create a packaged product. If the water is utilized for an irrigation source, the nutrients could reduce the need for fertilizer applied to the land.
  - Must communities always construct wetlands; can an existing wetland be used?
    - Existing wetlands can be used but the addition of nutrients will change the plant community to plants that thrive in a nutrient rich environment and cattails will flourish.
  - Must land always be purchased outright or are there options?
    - It is typical for the land to be purchased outright. Donations are rare. An unconventional land usage scenario isn't typical, but it certainly could be considered.

Wakarusa WRF

Agenda
Public Meeting #2

Wakarusa Water Reclamation Facility
Monday, January 23, 2006
7:00 to 8:30 pm
South Junior High School

Introductions	**5 minutes**

- City Staff
  - End user of facility
- Public Advisory Committee
  - Conduit for public input
  - Engagement through the evaluation process
- Black & Veatch
  - Technical Consultant for wastewater collection & treatment
- Patti Banks Associates
  - Outreach coordinator
- Bartlett & West
  - Surveying
- HNTB
  - Permitting
- General population at large
  - Input on acceptability, site utilization, & aesthetics.

Process Overview/Update — **5 minutes**

Stakeholder Report — **5 minutes**
- Findings

Public Survey — **10 minutes**
- Results

Criteria Report — **25 minutes**
- General overview
- Results

Explanation of Open House Activity — **10 minutes**

Open House — **20 minutes**

Wakarusa Water Reclamation Facility
Public Meeting No. 2

January 23, 2006
7:00 to 8:30 pm

South Junior High School
2734 Louisiana

HNTB

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PATTI BANKS ASSOCIATES

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BARTLETT & WEST
ENGINEERS
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Agenda

- Introductions
- Process Overview/Update
- Stakeholder Report
- Public Survey
- Criteria Report
- Explanation of Open House Activity
- Open House

Introductions

- **City Staff**
  - End user of facility
- **Public Advisory Committee (PAC)**
  - Conduit for public input
  - Engagement through evaluation process
- **Patti Banks Associates**
  - Public outreach coordination

Introductions

- **Black & Veatch**
  - Technical consultant for wastewater collection and treatment
- **Bartlett & West**
  - Surveying
- **HNTB**
  - Permitting
- **General Public at Large**
  - Provide input on acceptability, site utilization, and aesthetics

Process Overview/Update

Activity	Date
PAC Introductory Meeting	10/26/05
Stakeholder Interviews	10/1/05 – 11/1/05
Public Meeting No. 1	11/3/05
PAC Workshop No. 1	11/15/05
Joint City/County/USD/KU/ HINU Meeting	12/1/05
PAC Bus Tour of Area	12/14/05
Public Wetlands Seminar	1/18/06
PAC Workshop No. 2	1/18/06
Public Meeting No. 2	1/23/06

Stakeholder Report

- Purpose & Perspectives Sought
- Project Awareness
- Considerations In Determining Viable Sites
- Amenities
- Wastewater Treatment Process
- Wastewater Rate Structure
- Growth Issues

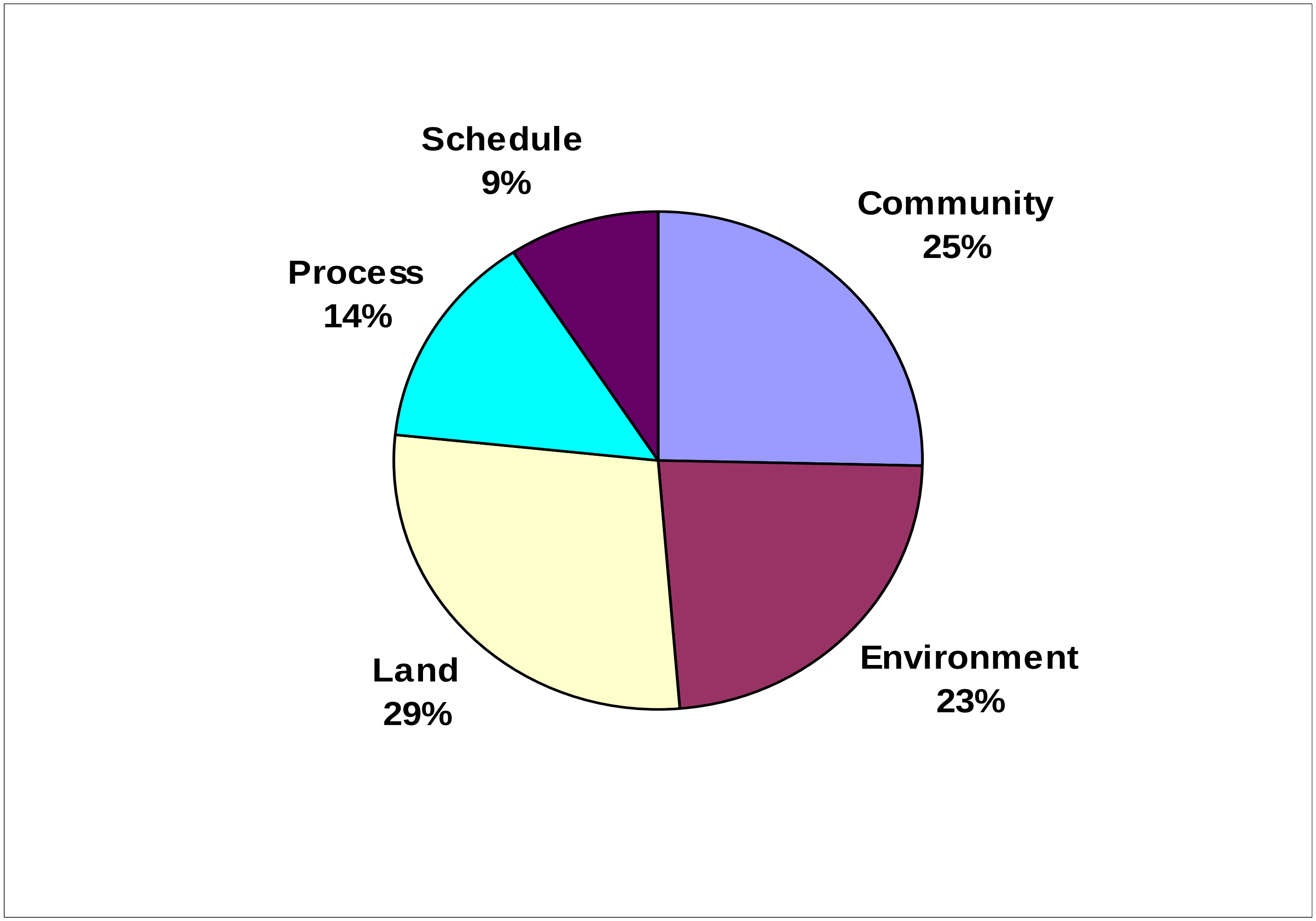
Public Survey Results

- Purpose
- Community Amenities Desired
  - Green space
  - Wetlands
  - Hike/bike trails
- Factors Which Concern You Most
- Willingness To Pay More For Amenities

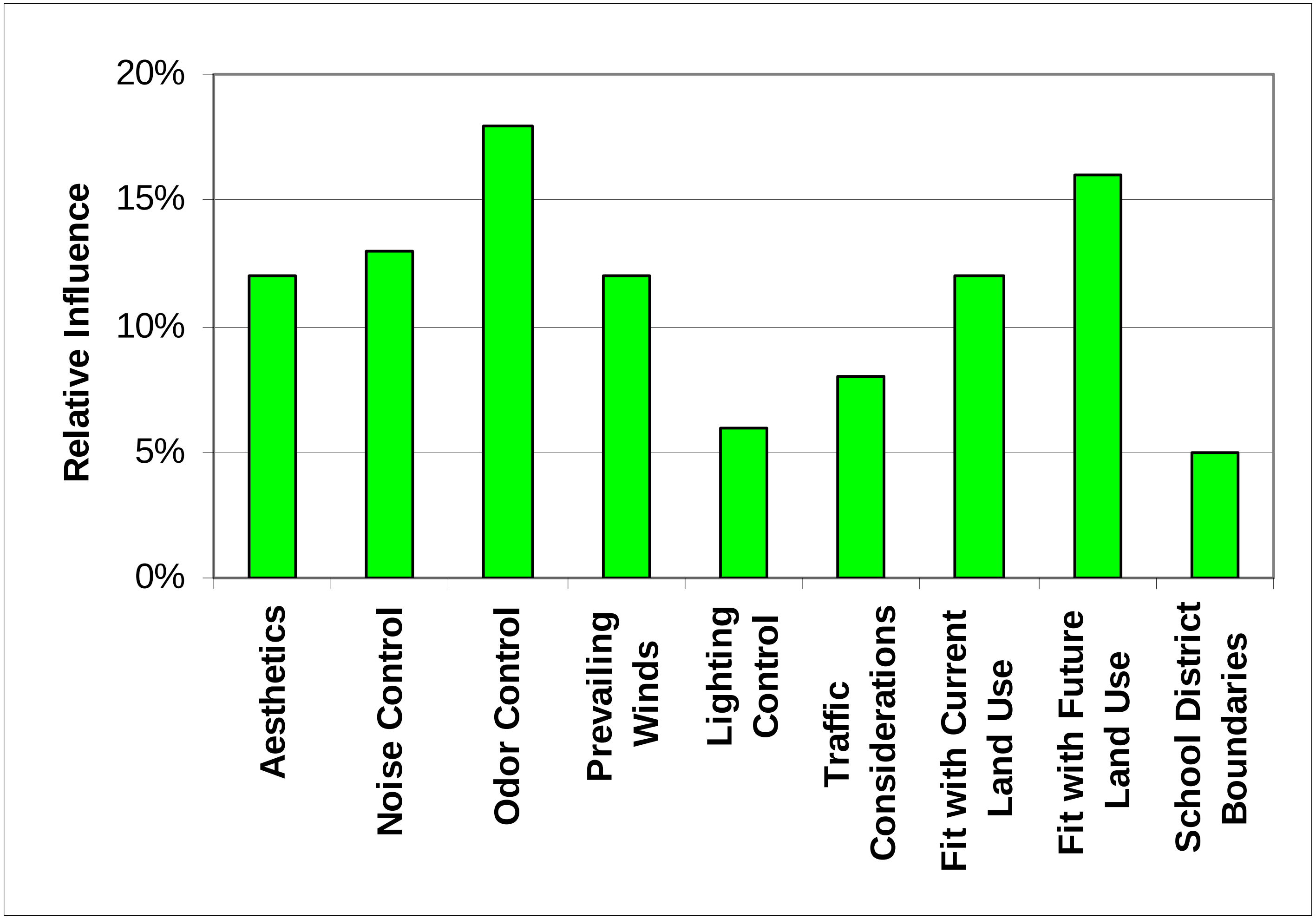
Criteria Report

- General overview
- Results

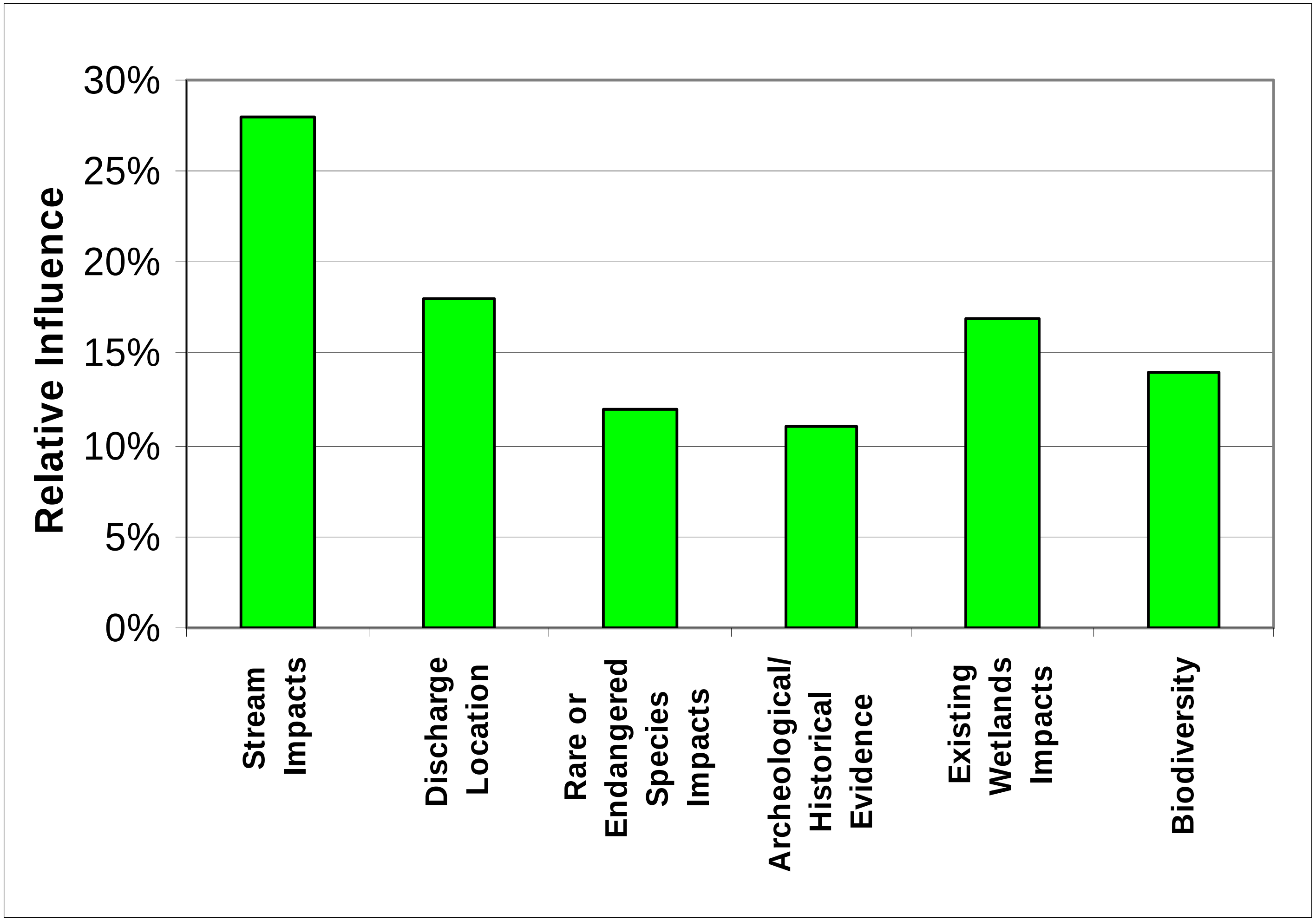
Primary Criteria
Average: PAC/Staff



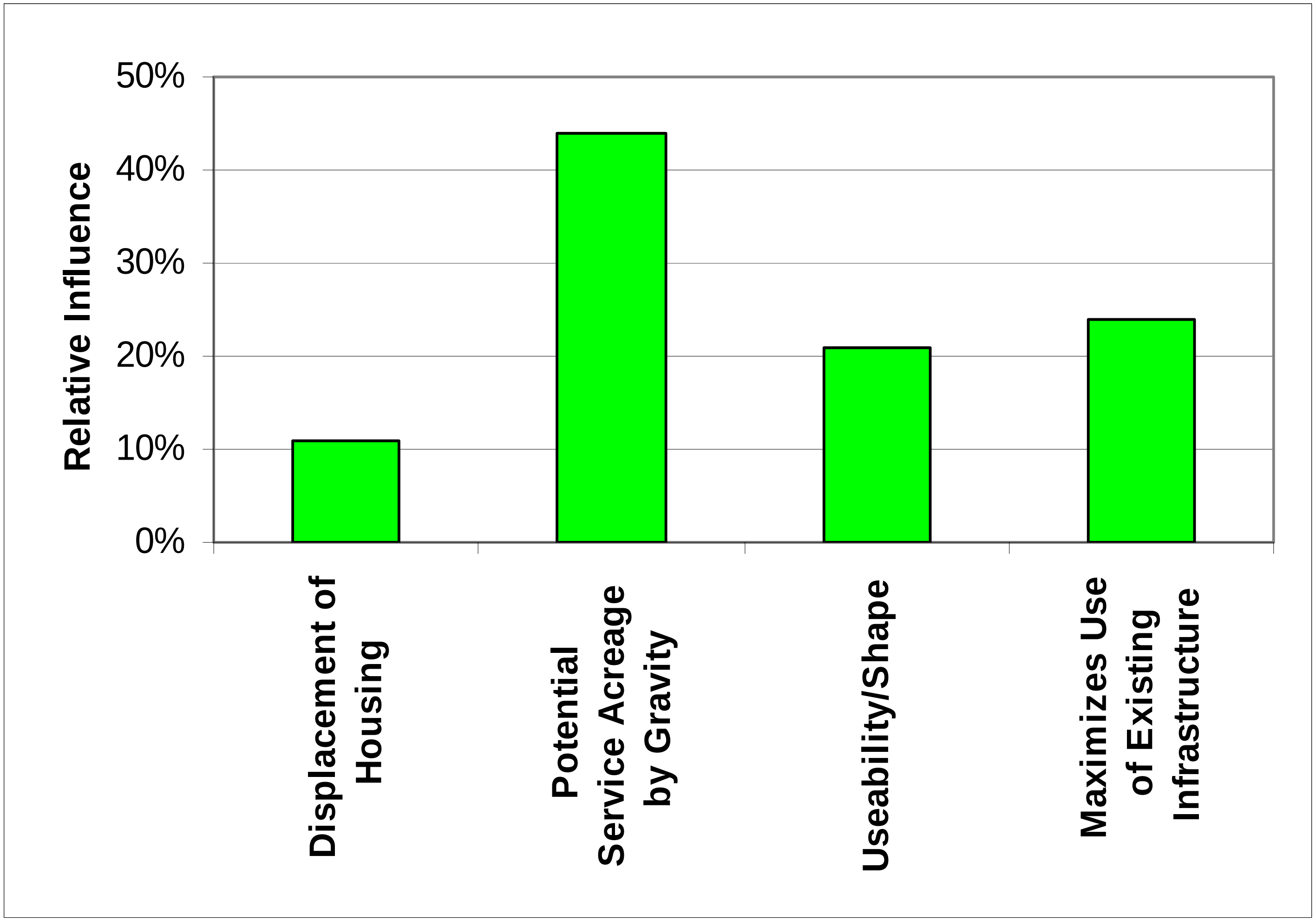
Community Sub-Criteria Average: PAC/Staff



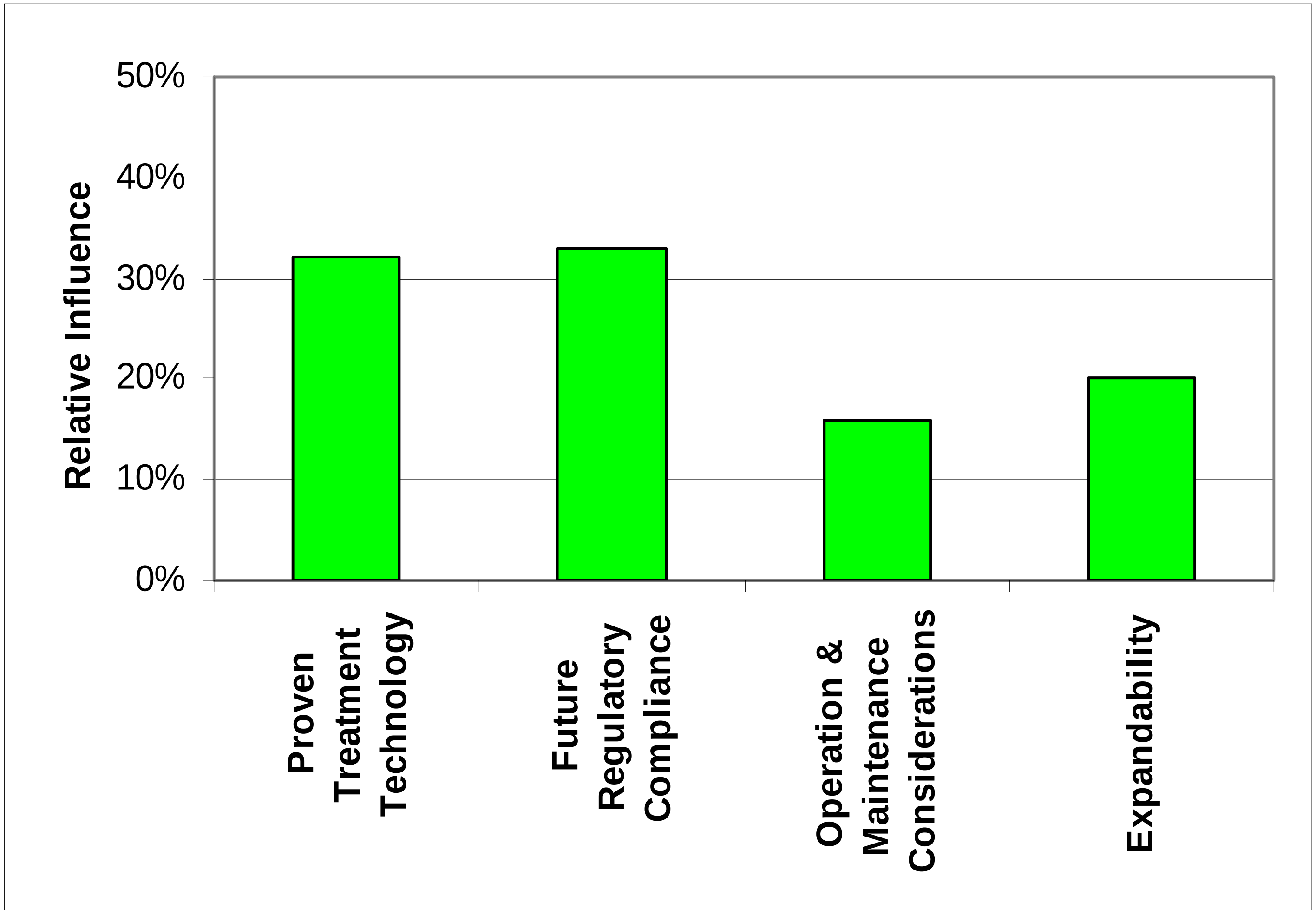
Environment Sub-Criteria
Average: PAC/Staff



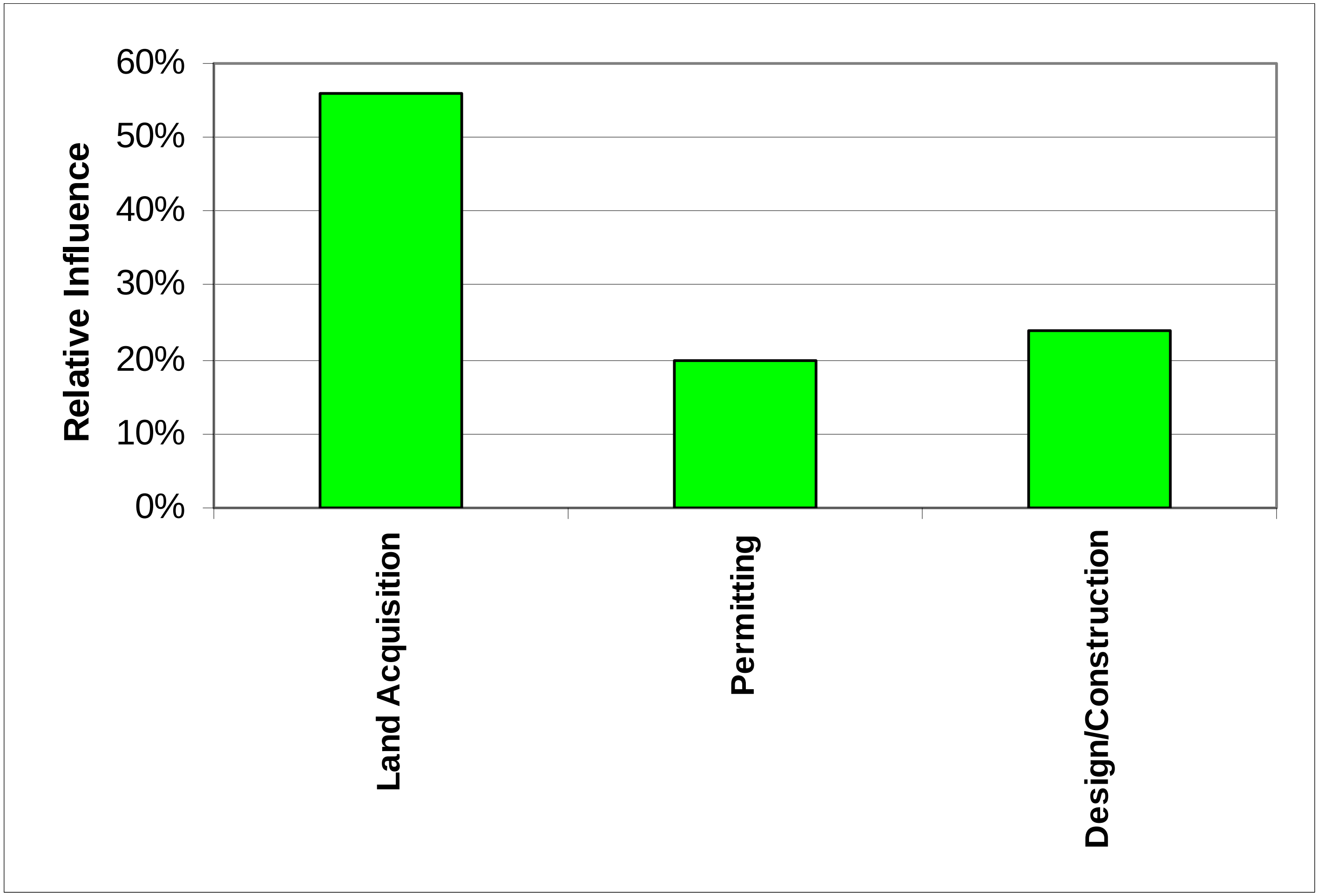
Land Sub-Criteria Average: PAC/Staff



Process Sub-Criteria Average: PAC/Staff



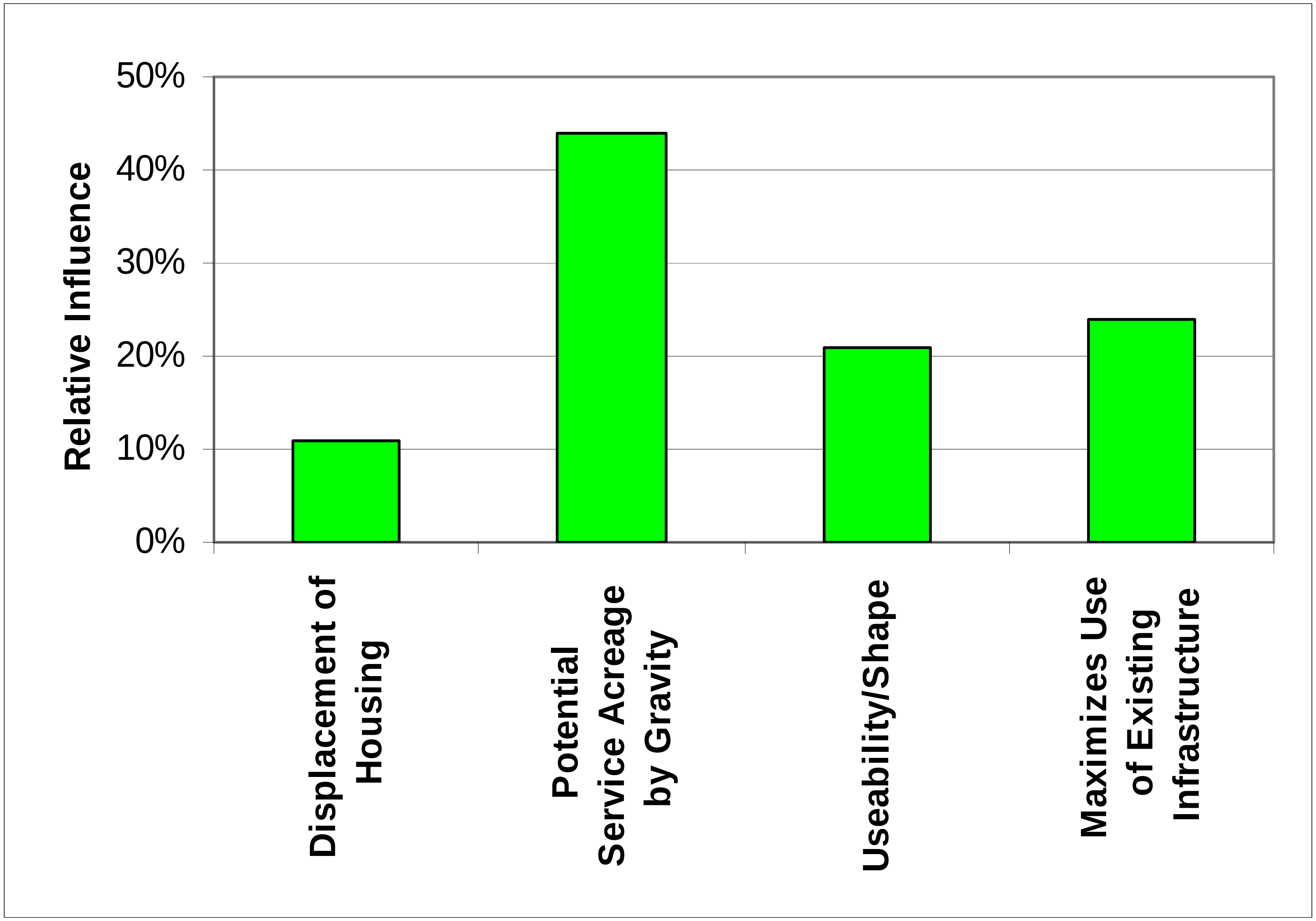
Schedule Sub-criteria
Average: PAC/Staff



Open House

- Explanation of Open House Activity
- Adjourn to lobby

Explanation of Open House Activity



Wakarusa Water Reclamation Facility
Public Meeting No. 2

Thank you for your participation!

For more information, please visit

http://www.lawrenceutilities.org/wwrf/index.shtml

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MEETING MINUTES

Project: Wakarusa WRF
Date: **January 23, 2006**

Wakarusa WRF Public Open House #2

Attendance:

More than 20 community residents, representatives from the Public Advisory Committee, City Staff, and Consultant Team were in attendance at the second public open house held January 23, 2006 at South Junior High School from 7:00 p.m. to 8:30 p.m. (See attached sign-in sheet).

Introductions and Project Team:

- Patti Banks (Patti Banks Associates) opened the meeting and asked the audience how many were attending their second WRF public meeting (25%), if they could see the screen and hear her voice. Banks then outlined the roles of City Staff, Public Advisory Committee, Consultant Team, and the general public. Banks then reviewed the evening agenda as follows:

  Agenda
  - Introductions
  - Process Overview & Update
  - Stakeholder Report
  - Public Survey Results
  - Criteria Report
  - Explanation of Open House Activity
  - Open House

Process Overview/Update:

- Banks summarized project activities to date, illustrated the amount of work completed to date and where we were in the process as follows:

PAC Introductory Meeting	October 26, 2005
Stakeholder Interviews	October 1 – November 1, 2005
Public Meeting No. 1	November 3, 2005
PAC Workshop No. 1	November 15, 2005
Joint City/County/USD/KU/HNTB Meeting	December 1, 2005
PAC Bus Tour of Area	December 14, 2005
Public Wetlands Seminar	January 18, 2006
PAC Workshop No. 2	January 18, 2006
Public Meeting No. 2	January 23, 2006

Stakeholders Report:

- Banks said that as part of the public involvement process community stakeholders were interviewed to provide background information on which issues were most important to the public. Twenty-five interviews were conducted in which thirty-six people participated over a several week period. The participants included elected officials, property owners, business owners, neighborhood representatives, environmental groups, city staff, and education representatives. Findings gathered from the interviews focused on the following topics: consideration in determining viable sites, amenities, wastewater treatment process, wastewater rate structure, and growth issues. Banks summarized the finding of each and directed the group to the project website for more detail.

- **<u>Discussion</u>**
  - Who are the stakeholders and who selected them?

Public Survey:

- Banks explained that at the November 3rd open house participants were asked to complete a survey with questions designed to solicit the communities ideas on what's important in siting the facility and give input on the types of activities the community would prefer to see surrounding it. Banks summarized the results as follows:

  <u>Survey Results</u>
  - Green space, wetlands, and hiking/biking trails as the most preferred amenities for the proposed plant.
  - Residents were most concerned about the control of odors, aesthetics/architectural character, and the impact of truck traffic.
  - Residents were willing 3:1 to pay more in wastewater rates to provide amenities that draw the public to the facility and require additional odor control measures

Criteria Report:

- Mike Orth (Black and Veatch) explained that primary criteria and sub-criteria for site selection were developed and that staff and the PAC had reviewed and scored each set of criteria. The scores collected were averaged to create the combination City staff/PAC percentages below and illustrate items with the most and least amount of relevant influence for site selection. Orth presented each sub-criteria and took questions after each as follows:

  <u>Primary Criteria</u>
  - Community 25%
  - Environment 23%
  - Land 29%
  - Process 14%
  - Schedule 9%

  <u>Community Sub-Criteria</u>
  - Aesthetics
  - Noise Control
  - Odor Control **(Most Influence)**
  - Prevailing Winds
  - Lighting Control
  - Traffic Considerations
  - Fit with Current Land Uses
  - Fit with Future Land Uses
  - School District Boundaries **(Least Influence)**

- **<u>Discussion Community Sub-Criteria</u>**
  - School district boundaries are listed as sub-criteria. – Are annexation costs included in the study?
  - Has a facility within the city limits been contemplated even if the limits must be extended?

- What is the relevance of school district boundaries to this study and if you lived in the Baldwin District would it apply?
- What about flood control and shouldn't it be a big influence since it affects the farmers?

Environment Sub-Criteria

- Stream Impacts **(Most Influence)**
- Discharge Location
- Rare or Endangered Species Impacts
- Archeological/Historical Evidence **(Least Influence)**
- Existing Wetlands Impacts
- Biodiversity

  - **Discussion Environment Sub-Criteria**
    - If you don't want to impact the environment, why isn't the green bar 100%?
    - What is biodiversity?
    - Graphs: use math, not that point system; are these bars correct; and, how does politics impact this in the end?
    - How much are seven (7) million gallons and what impacts will it have on streams?
    - Will effluent be used?
    - Seven (7) million gallons per day – what is the estimate for the new plant and will it be a big impact on the Wakarusa watershed?
    - What methods are used in calculating the impacts of development in the floodplain?
    - How has Clinton Lake impacted the Wakarusa?

Land Sub-Criteria

- Displacement of Housing **(Least Influence)**
- Potential Services Acreage by Gravity **(Most Influence)**
- Usability/Shape
- Maximizes Use of Existing Infrastructure

  - **Discussion Land Sub-Criteria**
    - Is there a figure established relative to sea level?
    - How will floodplain issues be reconciled with issues raised by the Corp of Engineers and associated costs?
    - Is proximity of development a factor?
    - If the footprint is "X", the factors are in the stew, how would flow impact site shown on the eastern edge of the project study area?
    - Does the Wakarusa River fall steeper?
    - Will the Wakarusa WRF become the primary facility?
    - What capacity is the existing plant at?

Process Sub-Criteria

- Proven Treatment Technology
- Future Regulatory Compliance **(Most Influence)**
- Operations and Maintenance Considerations **(Least Influence)**
- Expandability

  - **Discussion Process Sub-Criteria**
    - No comments.

<u>Schedule Sub-Criteria</u>

- Land Acquisition **(Most Influence)**
- Permitting **(Least Influence)**
- Design/Construction

  - **<u>Discussion Schedule Sub-Criteria</u>**
    - Is any consideration given for construction impacts on the roadways, such as traffic trips, construction impacts, width of roads, and size of vehicles?
    - What happens when a plant stops working?
    - Will the project take place in the existing city limits?
    - Can <u>any</u> sewage go to this plant?
    - Will roadways be improved first?
    - If the plant services the south and west areas, when will it be open for service and what other southern area will be annexed as a result?

Explanation of Open House Activity:

- Orth explained that the remainder of the meeting would be an open house during which participants were invited to discuss the sub-criterion with staff and participate in a ranking exercise using dots and the sub-criteria graphs shown in this presentation.

Eco Machine Presentation and Peer Review Panel

March 1, 2006

Jonathan Todd is the Senior Partner of John Todd Research and Design, Inc. a firm involved in the development of ecological technologies for food production, waste purification and conversion, environmental restoration and systems integration for architecture and eco-industrial parks. In 1995, he joined John Todd Research and Design, Inc., first in pond management and then into the design, fabrication and operation of a wide variety of living machines and floating water restorer technologies for clients in Canada, Hawaii, Georgia, New Mexico, Maryland, Massachusetts, and Vermont.

David Austin, Vice President of Ecological Design, has been engaged full time in design, operation, project management, and technology development of advanced ecologically engineered wastewater treatment systems since 1996. He is one of two leading Living Machine® wastewater treatment system professional engineer designers world wide, and is a leading expert in tidal flow wetland treatment systems. Mr. Austin has previously served as Director of Research and Development for Living Machines, Inc. and Operations Manager of Living Technologies, Inc. He is a Professional Engineer and a certified Ecologist by the Ecological Society of America and an advanced Small Systems Wastewater Treatment Operator.

John Metzler is the Chief Engineer with Johnson County Wastewater, which operates three treatment plants in heavily residential areas. Mr. Metzler's previous experience as a KDHE regulator as well as his current position with Johnson County Wastewater allows him to be intimately familiar with the need to provide neighbor-friendly facilities. As Chief Engineer, he is responsible for supervising the planning, design, construction, financing and administration of wastewater collection and treatment facilities and management of $250 million capital improvements program.

Dr. Ross McKinney, Professor Emeritus of Civil Engineering at the University of Kansas has over 40 years experience in wastewater treatment research, teaching, and consulting. Dr. McKinney is a recognized expert in wastewater treatment and research due to his contributions to the development of biological wastewater treatment processes and to the advancement of the environmental engineering profession.

Karl Mueldener, Bureau of Water Director for Kansas Department of Health & Environment, has been involved with state drinking water and wastewater programs with the KDHE since 1975, and serving as director since 1988. He is a graduate of Kansas State University with an M.S. in Civil Engineering.

Charlie Stryker is the President and Owner of CAS Construction, Inc., a plant contractor specializing in the construction, repair, rehabilitation and renovation of water and wastewater treatment facilities. The company has completed more than 350 projects from Maine to Wyoming. Before establishing CAS Construction in 1985, Mr. Stryker had worked as an engineer designing water and wastewater facilities. He also worked for two construction firms holding positions from senior engineer to chief executive officer. Mr. Stryker is a licensed contractor in 19 states and is a block-tested master mechanical and master plumber. He also is a licensed professional engineer in seven states.

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Wakarusa Water Reclamation Facility
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Public Advisory Committee

Charles Jones
Douglas County - Board of County Commissioners

Roger Pine
State of Kansas Senate

Dr. Terry Riordan, MD
Lawrence/Douglas County Planning Commission

Tom Bracciano
Lawrence Public Schools - Facilities and Operations Planning

Warren Corman
University of Kansas - Business and Financial Planning

Rod Geisler
KDHE, Bureau of Water

Lavern Squier
Lawrence Chamber of Commerce

Michael Campbell
Kansas Sierra Club (Wakarusa Group)

Mary Lynn Stuart
Lawrence Preservation Alliance

Michael Caron
Save the Wakarusa Wetlands

Carrie Lindsey
League of Women Voters - Lawrence/Douglas County

Alison Reber
Kaw Valley Heritage Alliance - Kansas StreamLink Program

Bobbie Flory
Lawrence Home Builders Association

Laura Calwell
Kansas Riverkeepers - Friends of the Kaw

Michael Almon
Interested Citizen

John Craft
Neighbor to Kaw WWTP

Charles Hawkins
Haskell Indian Nations University

Mike Rundle
Lawrence City Commission

Mike Amyx
Lawrence City Commission

Mike Bowman
Interested Citizen

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Wakarusa Water Reclamation Facility
www.lawrenceutilities.org/wwrf

Agenda
Public Meeting No. 3
Wakarusa Water Reclamation Facility

Date:	May 10, 2006
Time:	7:00 to 8:30 pm
Location:	Commission Chambers, City Hall

<u>Welcome</u> (Van Saun)

<u>Meeting Objective and Introductions</u> (Van Saun) — 30 minutes

- Overview of Wakarusa Water Reclamation Facility study process

<u>Background</u> (Orth)

- Vision for ultimate build-out – 50 mgd
- Small, medium, large footprint technology considered
- Project timeline

<u>Public Input</u> (Orth)

- Public Advisory Committee (PAC) role
- Criteria selection and weighting of importance

<u>Review Alternatives</u> (Orth)

- Bus tour of sites
- Sites considered – show map with seven sites

<u>Decision Process</u> (Orth)

- Rank site/footprint alternatives according to criteria
- Develop cost estimates
- Results

<u>Next Steps</u> (Orth)

- Prior on-site investigations
- On-site investigations
- Begin collection system corridor and design studies

<u>Questions</u> (All) — 30 minutes

<u>Open House</u> (All) — 30 minutes

- Review maps and ask individual questions

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Wakarusa Water Reclamation Facility
www.lawrenceutilities.org/wwrf

Agenda
Public Meeting No. 3
Wakarusa Water Reclamation Facility

Serving the community, into the future...

Wakarusa Water Reclamation Facility Public Meeting No. 3

May 10, 2006

...it's what we do.

Wakarusa Water Reclamation Facility
www.lawrenceutilities.org/wwrf

BLACK & VEATCH

weknowwater@bv.com

Meeting Agenda

- Welcome
- Project Objective and Introductions
  - Background
  - Public Input
  - Review Alternatives
  - Decision Process
  - Next Steps
- Questions
- Open House

Project Objective

Provide overview of Wakarusa Water Reclamation Facility study process

Introductions

- **City Staff**
  - **Dave Corliss**, Interim City Mgr
  - **Debbie Van Saun**, Asst City Mgr
  - **Dave Wagner**, Asst Dir Wastewater
  - **Lisa Patterson**, Communication Mgr
  - **Philip Ciesielski**, Utilities Engineer
  - **Mark Hegeman**, Wastewater Treatment Mgr
  - **Scott Wagner,** Legal Assistant
- **Patti Banks Associates**
  - **Patti Banks**
  - **Lisa Briscoe**
- **Black & Veatch**
  - **Mike Orth**, Project Director
  - **John Keller**, Project Manager
  - **Page Surbaugh**, Design Engineer
- **HNTB**
  - **John Pasley**, Project Manager
  - **Jen Johnson**, Project Engineer
  - **Pete Jarchow**, Hydraulics
- **Bartlett & West**
  - **Joe Caldwell**, Project Manager
- **Acquisition Team**
  - **Dan Watkins**, Law Offices of Dan Watkins
  - **Tim Orrick**, Foth & Orrick
  - **Jason Prier**, Foth & Orrick

FOTH & ORRICK, L.L.P.
ATTORNEYS AT LAW

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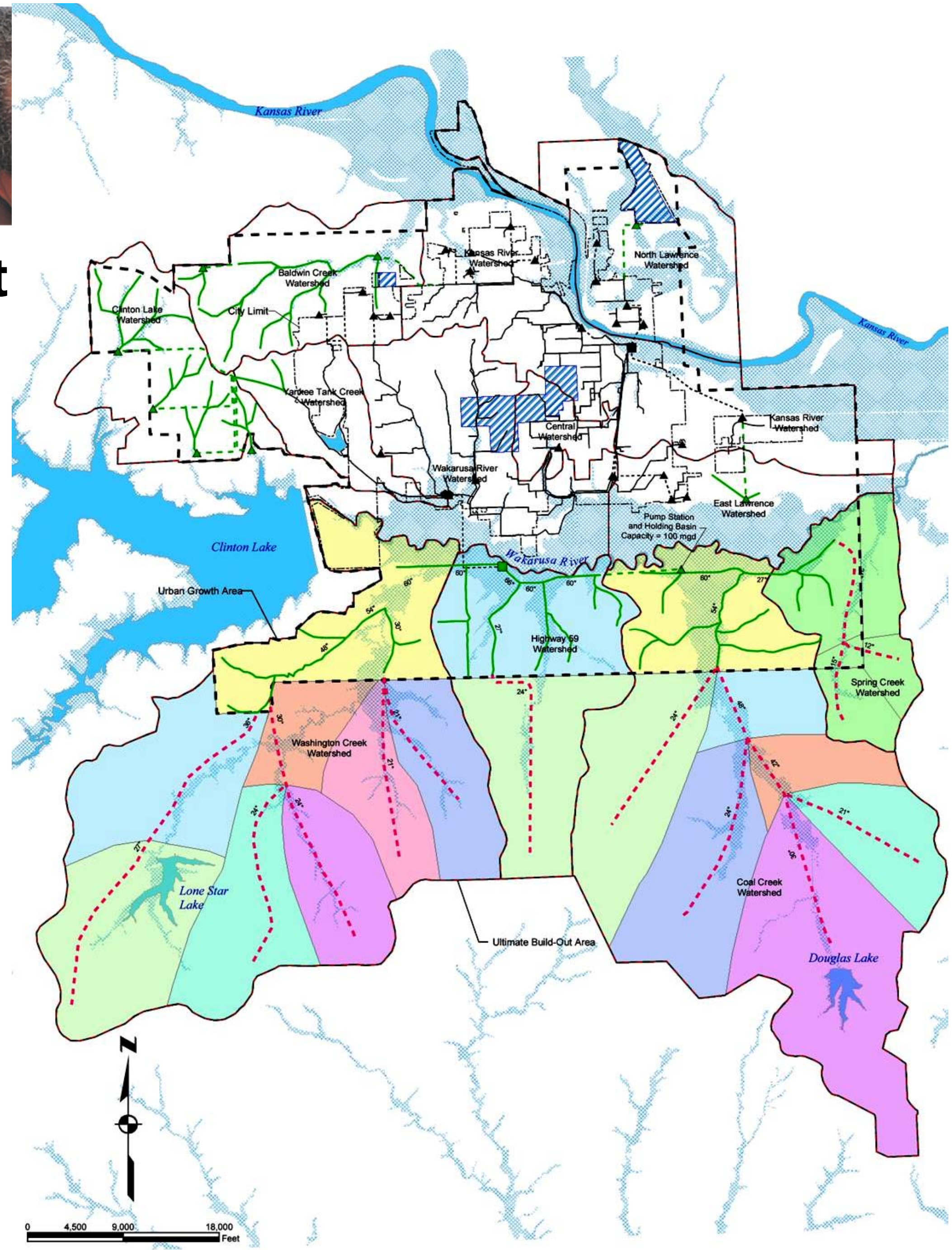
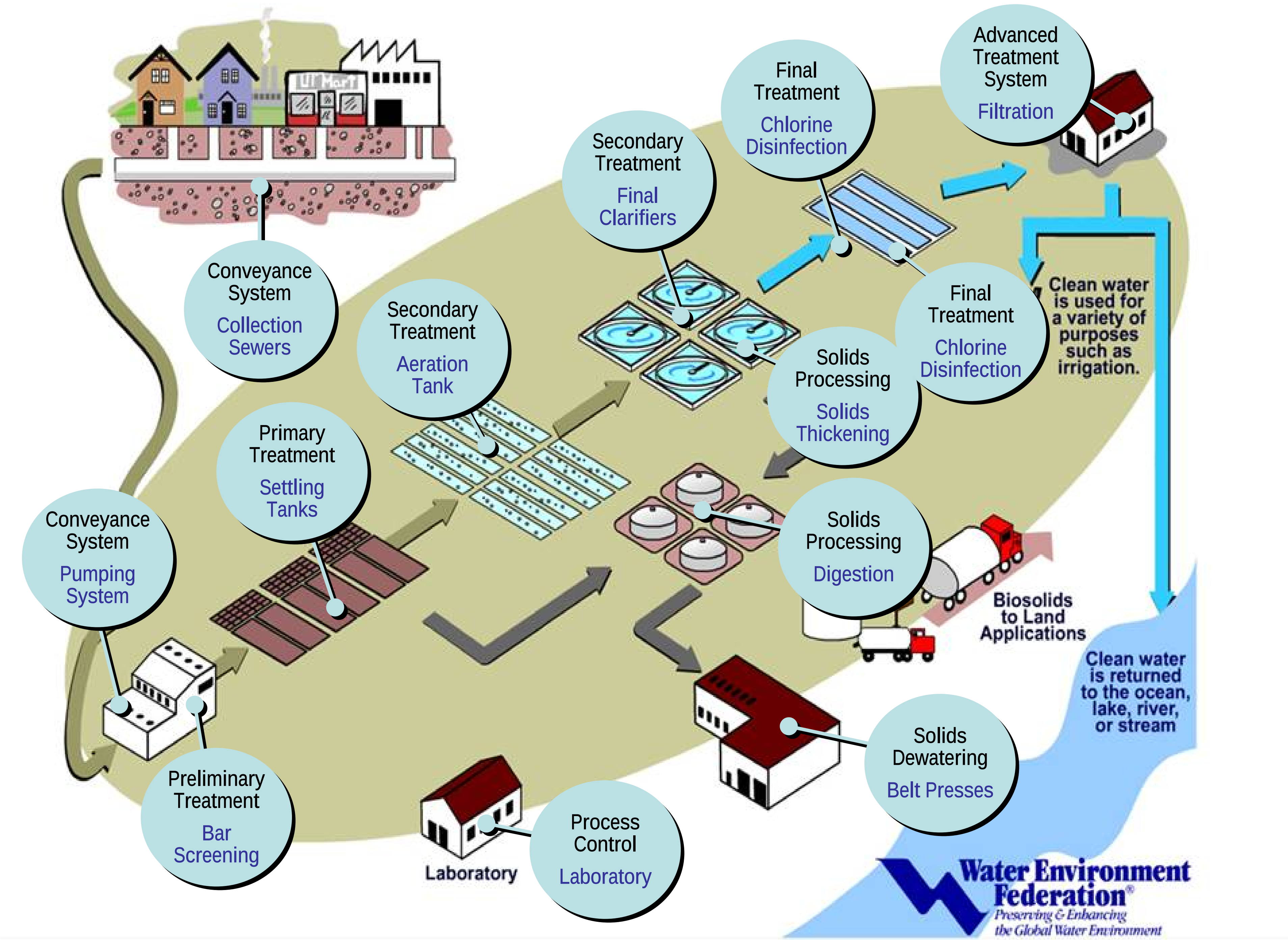
Vision for Ultimate Build-out 50 mgd

- 7 million gallon/day (mgd) plant capacity needed by 2011





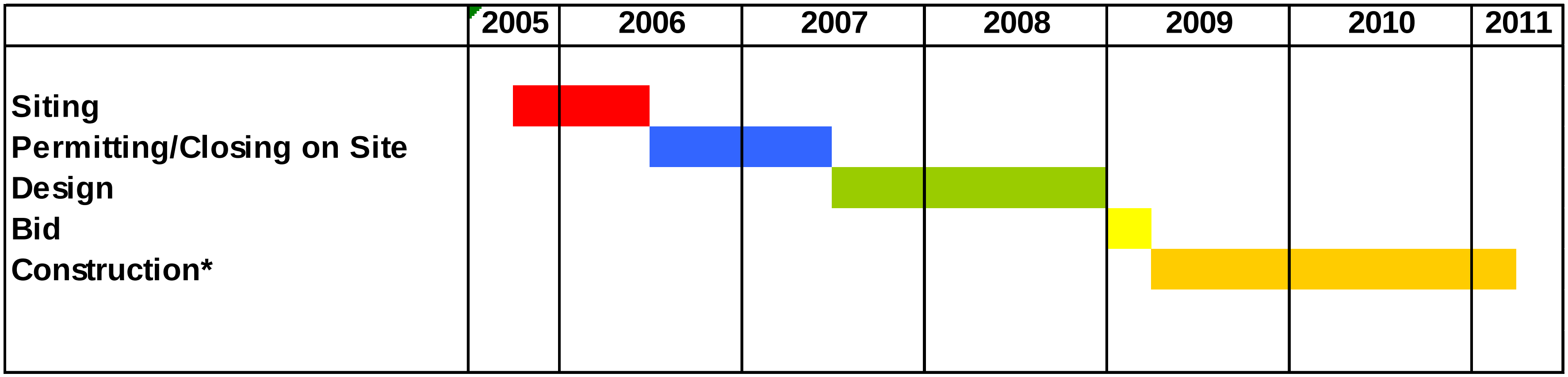
Conveyance System
Collection Sewers
Secondary Treatment
Aeration Tank
Secondary Treatment
Final Clarifiers
Final Treatment
Chlorine Disinfection
Advanced Treatment System
Filtration
Final Treatment
Chlorine Disinfection
Clean water is used for a variety of purposes such as irrigation.
Solids Processing
Solids Thickening
Primary Treatment
Settling Tanks
Conveyance System
Pumping System
Solids Processing
Digestion
Biosolids to Land Applications
Clean water is returned to the ocean, lake, river, or stream
Solids Dewatering
Belt Presses
Preliminary Treatment
Bar Screening
Laboratory
Process Control
Laboratory
Water Environment Federation
Preserving & Enhancing the Global Water Environment

Footprint Alternatives Considered

Alternative	Acreage Required*
Small	235
Medium	300
Large	1000

Includes wet-weather treatment, solids management, and buffer.

Wakarusa Water Reclamation Facility Timeline



* Construction schedule assumes conventional Design-Bid-Build approach

- Schedule compression required to have facility complete by 2011
  - Site acquisition time reduction
  - Start preliminary design early
  - Consider design/build

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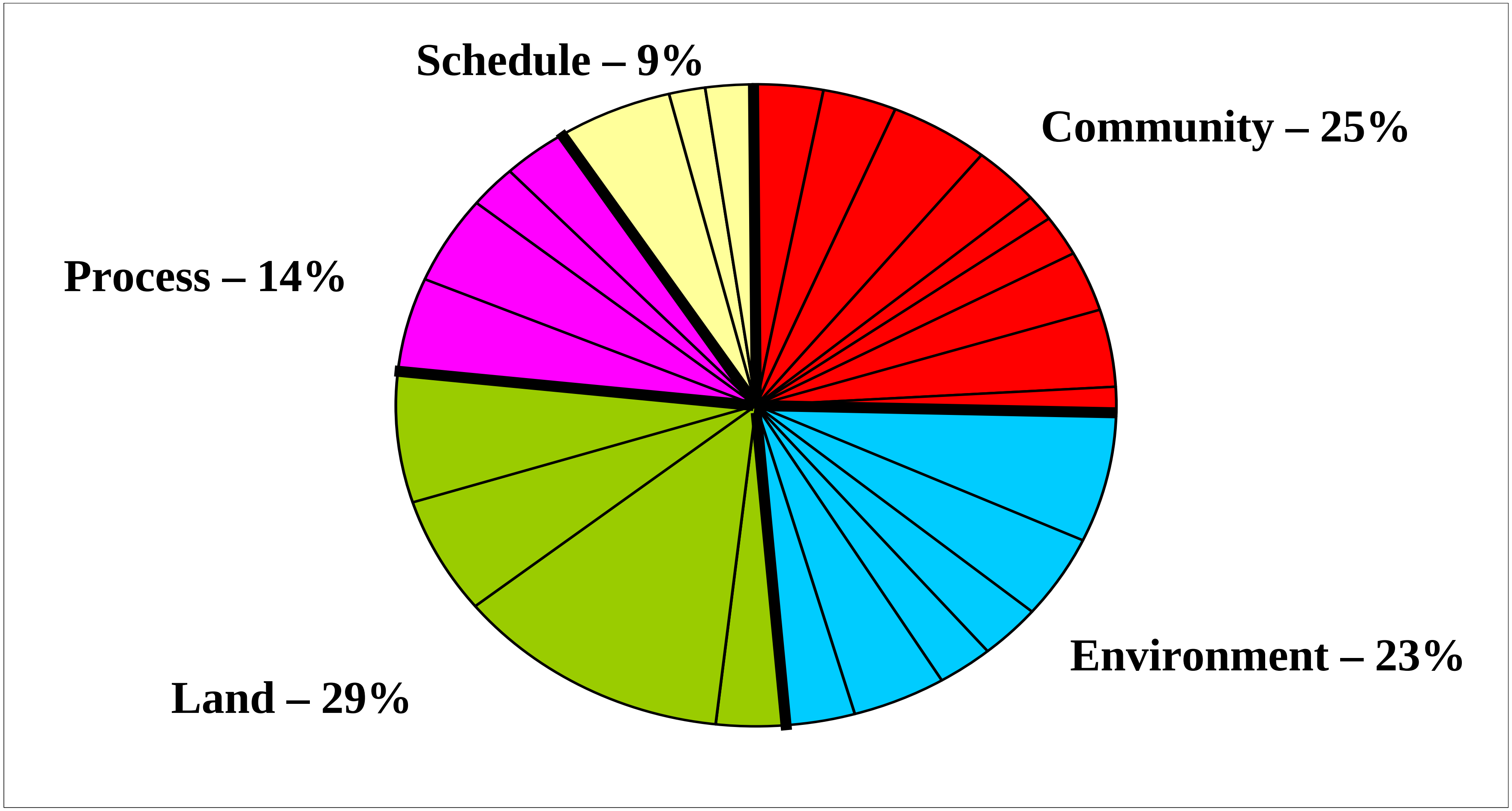
Public Advisory Committee Role

Guide process by providing a voice for community members with regard to site utilization and aesthetics

- **Mike Amyx**, City of Lawrence
- **Mike Rundle**, City of Lawrence
- **Charles Jones**, Douglas County
- **Roger Pine**, KS State Senate
- **Terry Riordan,MD**, Lawrence/Douglas County Planning Commission
- **Tom Bracciano**, Lawrence Public Schools
- **Warren Corman**, KU
- **Rod Geisler**, KDHE
- **Lavern Squier**, Lawrence Chamber of Commerce
- **Michael Campbell**, Kansas Sierra Club
- **Charles Hawkins**, Haskell Indian Nations University
- **Mary Lynn Stewart**, Lawrence Preservation Alliance
- **Michael Caron**, Save the Wakarusa Wetlands
- **Carrie Lindsey**, League of Women Voters
- **Alison Reber**, Kaw Valley Heritage Alliance
- **Bobbie Flory**, Lawrence Home Builders Association
- **Michael Almon**, Interested Citizen
- **Laura Calwell**, Kansas Riverkeepers
- **John Craft**, Neighbor to Kaw Wastewater Treatment Plant
- **Mike Bowman**, Interested Citizen

Selection Criteria and Weights



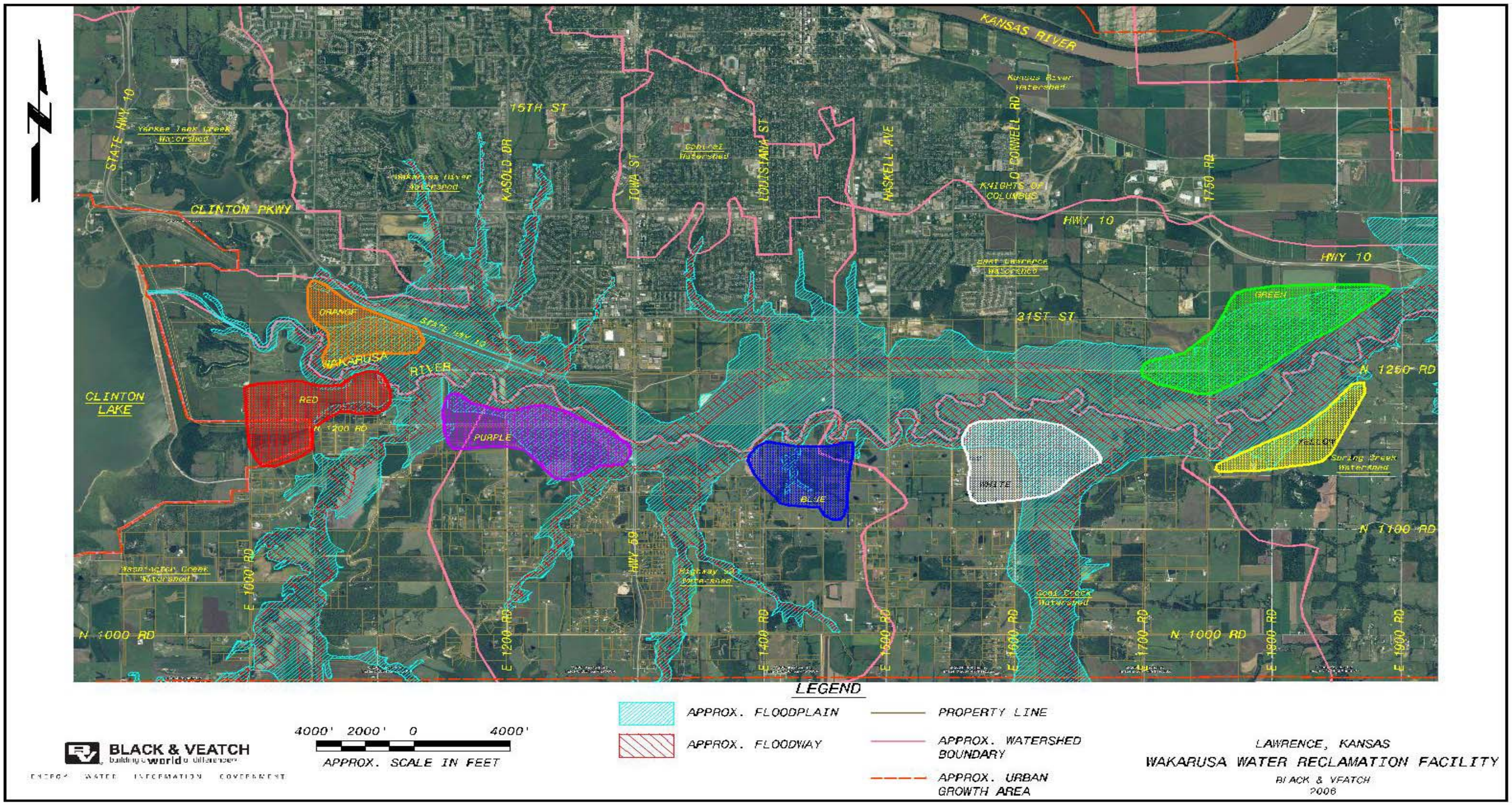
Relative Influence of Major Sub-criteria

- **Land**
  - Potential Future Service Area by Gravity
- **Community**
  - Odor Control
  - Fit with Future Land Use
- **Environment**
  - Stream Impacts
  - Discharge Location
  - Wetlands Impacts

Process to Review Alternatives

- Stakeholders' interviews
- Develop selection criteria
- Staff/Consultant area tour
- Bus Tour with Public Advisory Committee (PAC)
- Seven viable sites determined for further consideration

Seven Sites Considered



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Public Involvement in Decision Process

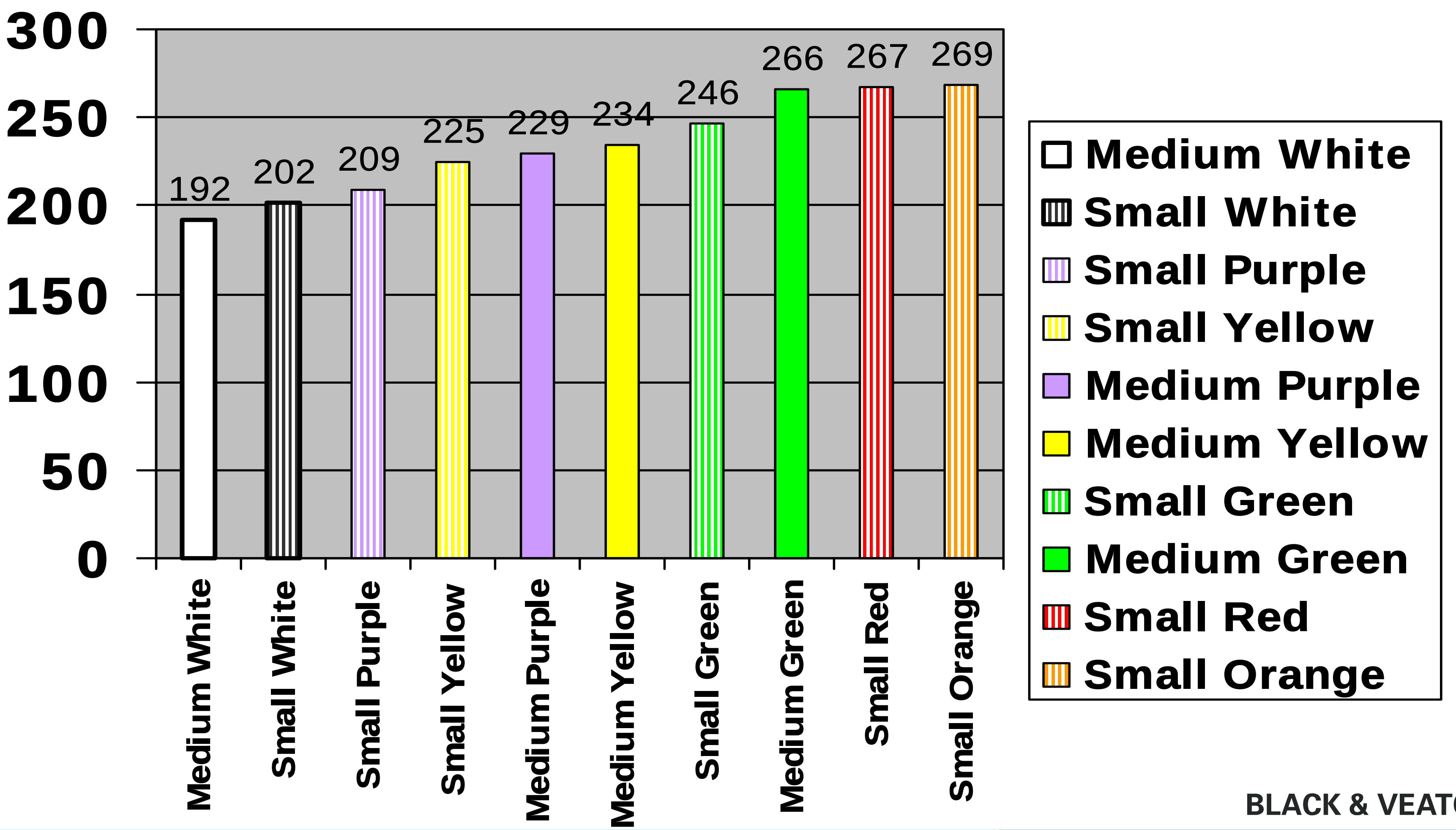
Activity	Date
PAC Introductory Meeting	10/26/05
Stakeholder Interviews	10/1/05 – 11/1/05
Public Meeting No. 1	11/3/05
PAC Workshop No. 1	11/15/05
PAC Bus Tour of Area	12/14/05
Public Wetlands Seminar	1/18/06
PAC Workshop No. 2	1/18/06
Public Meeting No. 2	1/23/06
Public Eco-machine Seminar & PAC Meeting	3/1/06
Potential Property Owner Notification	4/26/06
Public Meeting No. 3	5/10/06

Decision Process

- Rank site/footprint combinations
  - Series of workshops with PAC/City Staff
- Develop estimates for costs of each site/footprint combination
- Combine criteria scores with cost estimates to determine cost/benefit ratio
  - Estimates “value” per cost of facility construction/operations over 20-yr life
  - Allows for ranking of potential sites

Cost / Benefit Scores for the Top Ten Alternatives

(Lower score is better)



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Select Two Lowest Cost / Highest Value Alternatives

Two sites within 10% of each other

- Possible Advantages of White Site (Medium Footprint)
  - Relatively isolated site
  - Good location with regard to prevailing winds and odor impacts
  - Fit with existing and future land use
  - Discharges downstream of Haskell-Baker Wetlands
  - Lower present worth cost

- Possible Advantages of Purple Site (Small Footprint)
  - Higher benefit score
  - Lower collection system costs
  - Good access to roadways

Next Steps

- Studies prior to on-site investigations
  - Desktop evaluation of threatened & endangered species, wetlands, soils, hydraulics/hydrology
- On-site investigations
  - Survey, geotechnical, threatened & endangered species, cultural & historic resources, wetlands
- Begin collection system corridor and facility design studies

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Preliminary Desktop Study Findings

- Purple Site
  - Previously unrecorded barn, wooden railroad car, and various houses with outbuildings will require further architectural investigation
  - No known historic sites
  - No known threatened & endangered species present

Preliminary Desktop Study Findings (continued)

- White Site
  - Contains two recorded archeological sites but are not significant finds
  - Previously unrecorded abandoned homesite and concrete culverts will require further architectural investigation
  - No further investigation required on known historic sites
  - No known threatened & endangered species present
- Hydraulics/Hydrology
  - Negligible rise with initial construction
  - Ultimate build-out

Questions

Open House

- Opportunity to look at more detailed information
- Consultants/Staff will be available to answer individual questions
- Will continue until 8:30 pm

Serving the
community,
into the future...

Thank you for attending!!

...it's what we do.

Wakarusa Water Reclamation Facility
www.lawrenceutilities.org/wwrf

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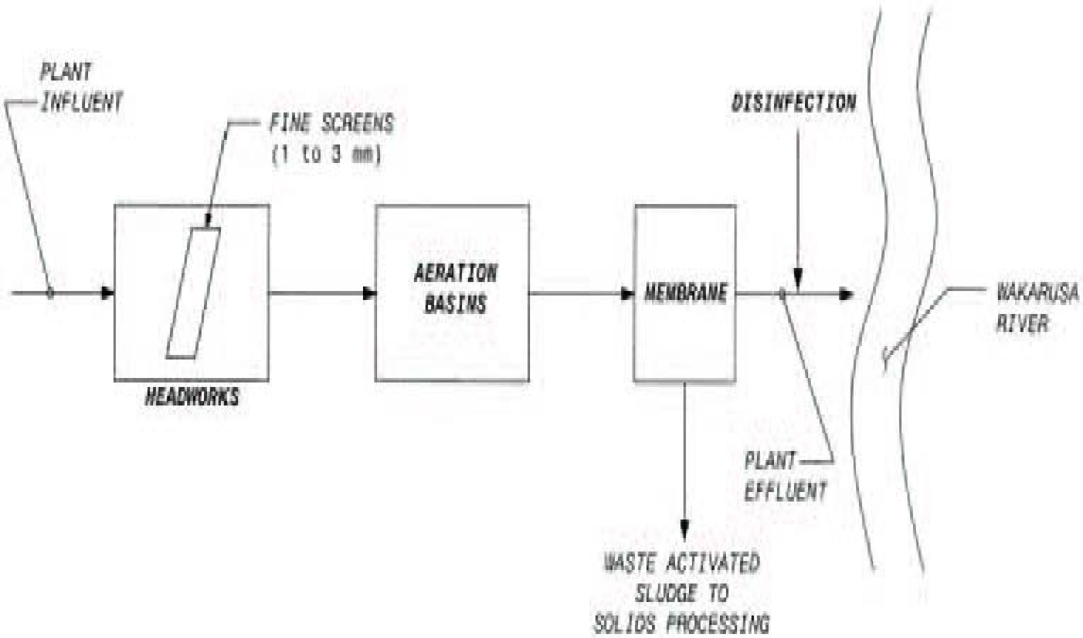
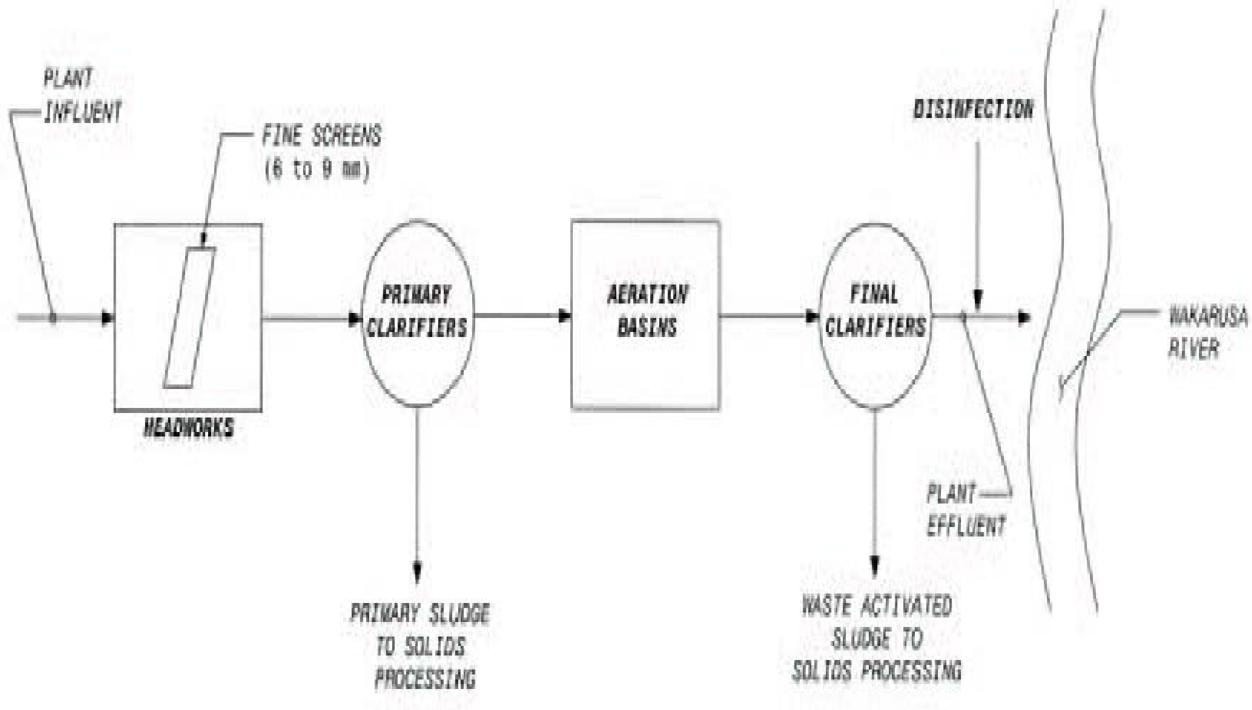
weknowwater@bv.com

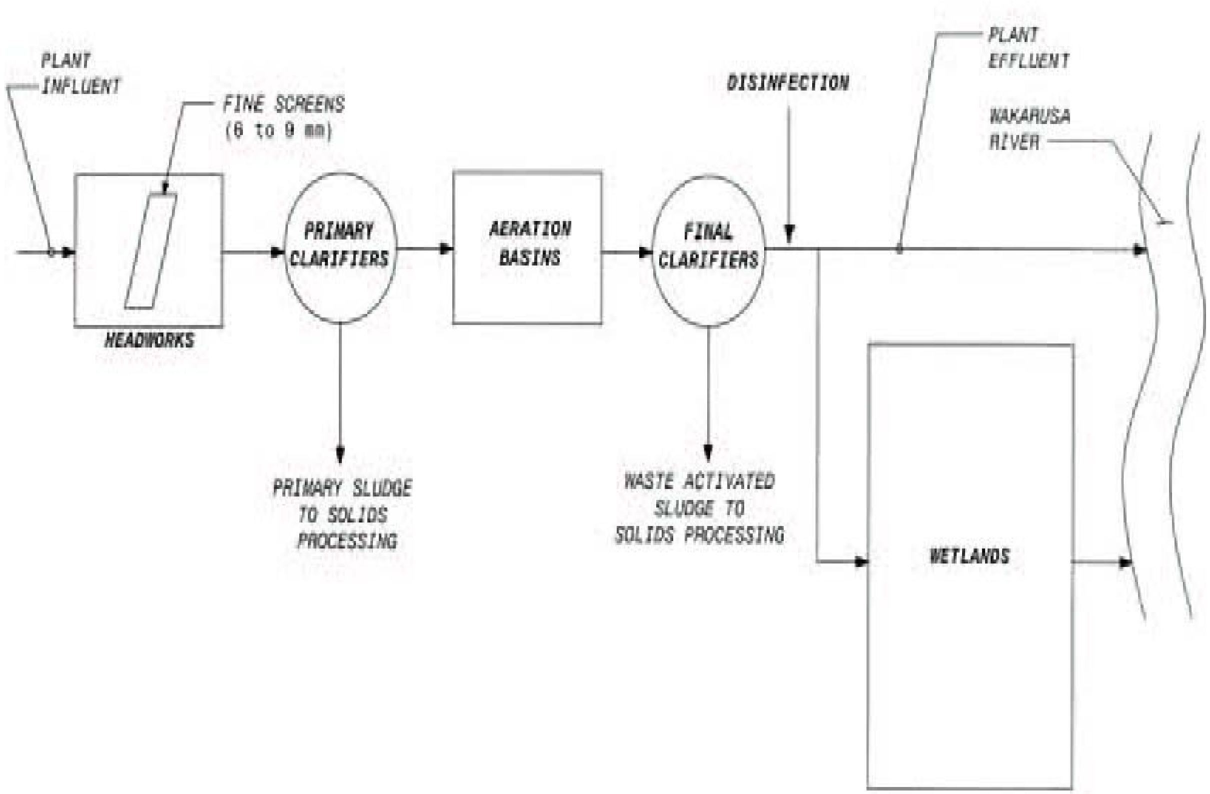
SMALL FOOTPRINT



MEDIUM FOOTPRINT



LARGE FOOTPRINT



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TRACKING THE WASTEWATER

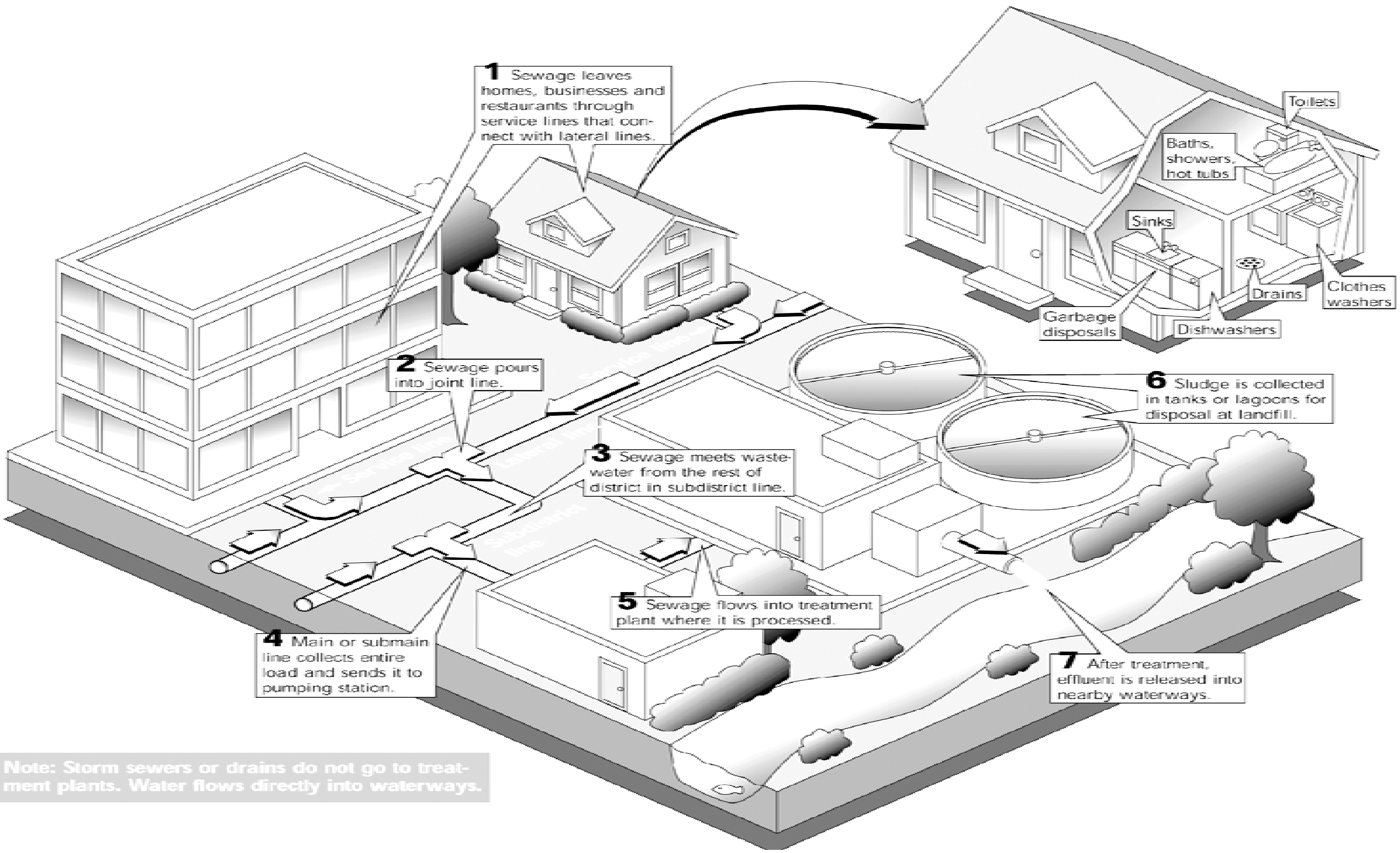
Sewage, which is almost all water, contains material such as chemicals and bacteria. Only a tenth of 1 percent is solid matter.

Through gravity and pumps, sewage is moved through a system of pipes from houses and businesses to a treatment plant.

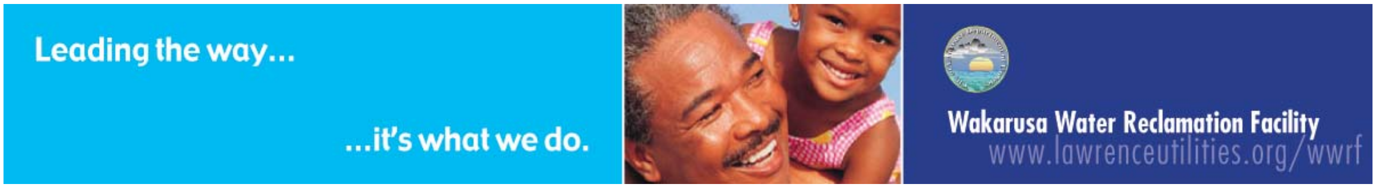
HOT SPOTS

Sources of sewage in your home

Wastewater originates from many sources in your home. Here are some of the more common points.



Note: Storm sewers or drains do not go to treatment plants. Water flows directly into waterways.



Meeting Minutes
Public Meeting No. 3
Wakarusa Water Reclamation Facility

Date:	May 10, 2006
Time:	7:00 to 8:30 pm
Location:	Commission Chambers, City Hall

Attendance:

More than 30 community residents, representatives from the Public Advisory Committee, City Staff, and Consultant Team were in attendance at the third public open house held May 10, 2006 at City Hall from 7:00 p.m. to 8:30 p.m.

Introductions and Project Team:

- Debbie Van Saun (Asst. City Manager) opened the meeting and introduced Mike Amyx (Mayor) who addressed the audience.

Meeting Objective and Introductions:

- Mike Orth (Black & Veatch) reviewed the meeting agenda, introduced the project team, and presented an overview of the Wakarusa Water Reclamation Facility study process.

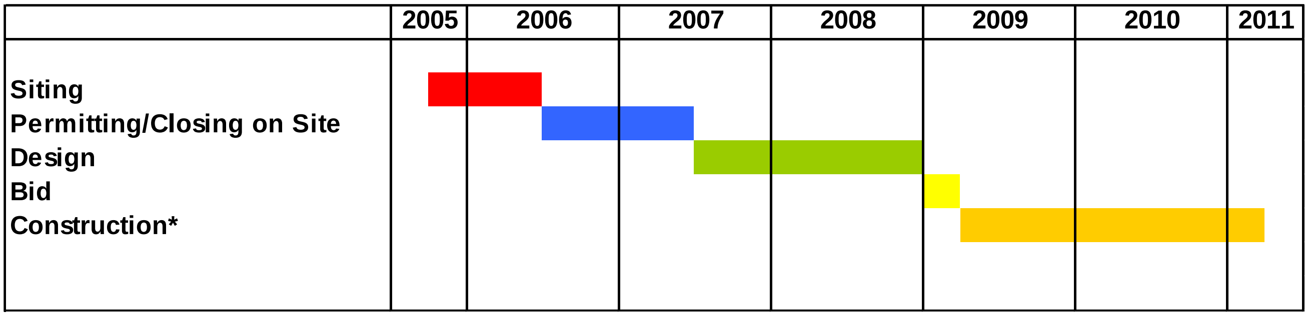
Background:

- Orth explained that the City of Lawrence desires to consider the spatial needs for the treatment facility to service the ultimate build-out scenario. Ultimate build-out should be considered when siting the Wakarusa WRF for long range planning purposes. Utilizing a 50-year planning horizon for the build-out acreage outside the Urban Growth Area (UGA), it was determined that the minimum treatment capacity required to service the build-out area, including areas within and outside of the UGA, is 50 mgd.
- Orth explained that the main categories of process alternatives that were considered include small, medium, and large footprint technologies. The evaluation of these footprint alternatives was completed at each of the seven general sites. Each of the area requirements includes a 1000 foot buffer on all sides for all treatment processes, excluding the wetland portion of the large alternative.

Acreage Requirements by Process Footprint Alternative

Alternative	Acreage Required*
Small	235
Medium	300
Large	1000

- Orth explained the project timeline and that compression of the schedule was necessary to have the facility completed by 2011, including: site acquisition time reduction, starting preliminary design work early, and consideration of design/build as an alternative form of project delivery.



* Construction schedule assumes conventional Design-Bid-Build approach

<u>Public Input</u>:

- Orth explained that public participation and input was a significant driver behind the study. The Public Advisory Committee (PAC) consisted of various individuals representing the community that have a focused area of interest regarding the siting of the facility. This group of 20 individuals was appointed by Mayor Highberger. The PAC input drove the project direction, including public acceptability factors, aesthetic fit within site location, and potential site utilization by the general public. The PAC also provided input on the site selection criteria and rankings of the potential sites and facility footprints.
- Orth explained that primary criteria and sub-criteria for site selection were developed and that staff and the PAC had reviewed and scored each set of criteria. The scores collected were averaged to create the combination City Staff/PAC percentages below and illustrate items with the most and least amount of relevant influence for site selection.

  <u>Primary Criteria</u>
  - Community 25%
  - Environment 23%
  - Land 29%
  - Process 14%
  - Schedule 9%

- Orth explained the overall relative influence of major sub-criteria included:
  - Land and servicing of potential future service area by gravity
  - Community issues regarding odor control and fit with future land use
  - Environmental concerns including stream impacts, discharge locations and wetlands impacts.

<u>Review Alternatives</u>:

- Orth outlined the process to review alternatives thru four primary steps. Stakeholder interviews were conducted to capture a diverse picture of public thoughts on the WRF. Participants were of varied backgrounds including elected officials, property owners, business owners, neighborhood representatives, environmental groups, higher education representatives, and city staff. Thirty-five people were interviewed. Concerns most frequently voiced were: protection of environmental and historical resources; odor control; aesthetics; and project fit with its surroundings.

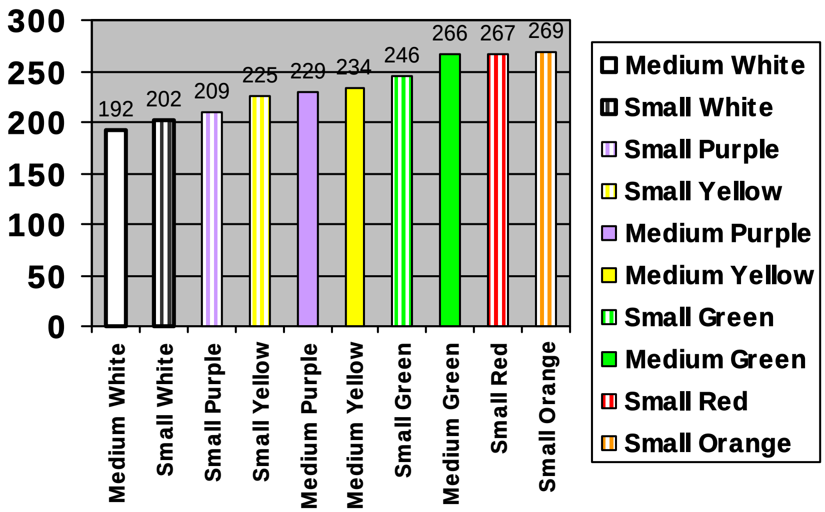
- The Staff/Consultant team members and PAC members were invited to attend a bus tour of the seven areas for potential consideration in siting the facility. PAC Member comments about each area were utilized by the Consulting team to assist in making the initial ranks of each of the sites against the selected criteria.
- Orth then discussed each of the seven sites utilizing the site map.
- Orth also outlined the public involvement steps in the decision process as follows:

Activity	Date
PAC Introductory Meeting	10/26/05
Stakeholder Interviews	10/1/05 – 11/1/05
Public Meeting No. 1	11/3/05
PAC Workshop No. 1	11/15/05
PAC Bus Tour of Area	12/14/05
Public Wetlands Seminar	1/18/06
PAC Workshop No. 2	1/18/06
Public Meeting No. 2	1/23/06
Public Eco-machine Seminar & PAC Meeting	3/1/06
Potential Property Owner Notification	4/26/06
Public Meeting No. 3	5/10/06

Decision Process:

- Orth explained that for each site and process footprint combination, a benefit/cost ratio was calculated. This cost/benefit score incorporates both project costs as well as PAC/staff-assigned benefit scores. A lower cost/benefit score indicates a better alternative, meaning those alternatives provide a higher value per unit cost.

Cost/Benefit Scores for the Top Ten Alternatives
(Lower score is better)



- Orth explained that high-level preliminary opinions of probable costs were completed for each of the three alternative technology footprints, at each of the sites for a total of 21 cost options. Capital costs were calculated to incorporate treatment facilities, including excess flow handling, and solids management for each of the three technology footprints, costs also included the purchase of land and any applicable housing. Infrastructure related costs were taken into account along with site specific mitigation costs as applicable.
- Orth outlined the two lowest cost/highest value alternatives as follows:

  Select Two Lowest Cost/Highest Value Alternatives

  Two sites within 10% of each other
  - Advantages of White Site
    - Relatively isolated site
    - Good location with regard to prevailing winds and odor impacts
    - Fit with existing and future land use
    - Discharges downstream of Haskell-Baker Wetlands
  - Advantages of Purple Site
    - Lowest collection system costs
    - Good access to roadways

Next Steps:
- Orth outlined the necessary studies to be completed prior to on-site investigations and summarized the results of desktop evaluations to date related to threatened and endangered species, wetlands, soils, and hydraulics/hydrology.
- Orth explained the steps necessary to obtain permission from property owners to access sites and to conduct the on-site investigations.
- Orth explained the future steps necessary to begin the collection system corridor and design studies.

Questions:
- Orth opened the floor to questions as follows:
  - Why are you looking at the Wakarusa River and not the Kaw River?
  - What is the reason for not looking for sites along the Trafficway?
  - What groups were represented by the Stakeholders interviewed?
  - You have illustrated three footprint sizes for the facility; will each have the same capacity?
  - I have an aerial photo of the '84 flood, would you like a copy?
  - What is the reasoning for not choosing the yellow and green sites?
  - How will odor be controlled or mitigated?
  - Have you determined the pipeline route?
  - Will there be an impact to our water bill?
  - Does each site require raising the facility above the flood plain?
  - Why is the green site so costly?

  - Would there be substantial cost savings for a site that does not require raising the facility above the flood plain?
  - Who determines the buffers?
  - What is the cost difference between small and medium size sites?
  - What route will serve as the truck assess to the white site?
  - Will archaeological due diligence be conducted? Note the existence of the old Terry Farm.
  - What happens to waste during a flood event? Will a backflow problem occur?
  - What is the benefit of this facility to those who live in the area? Will you compensate us?
  - How far out will the buffer and other systems protect residents?
  - What happens to the nitrates?
  - What is an effluent stream?
  - Are the basins sealed to secure groundwater sources and are they monitored?
  - Will the facility be energy self-sufficient?
  - What is the size of the East 8^{th} Street plant?
  - Will there be noise at the facility post construction?
  - Will 5900 Road be reconstructed?
  - Do you know the cost of the pipeline?

- Note: Senator Jim Barnett's Aid addressed the crowd and offered city officials assistance towards receiving state aid.
- Note: City staff offered to provide tours of the existing wastewater treatment facility located on East 8^{th} Street.

Open House:
- Orth explained that the remainder of the meeting would be an open house during which participants were invited to discuss the individual sites with staff.

Comment Card Results:
- What will become of a well that will be close to the white site? This is the only water available to the owner.
- What about property values – will this decrease the values in property?
- What happens to owners located to the west or north of 1600 Road when the winds come out of the east?

Wakarusa WRF

To: Mike Orth, Black & Veatch
Lisa Briscoe, Patti Banks Associates
From: Patty Gentrup
Subject: Stakeholder Interview Summary
Date: November 10, 2005

Introduction and Purpose

As part of the public involvement process to select a site for the Wakarusa Reclamation Facility in Lawrence, Kansas, interviews were conducted with various individuals identified by the City of Lawrence staff and the consultant team as having an interest in the facility location. The interviews were conducted by representatives of the Black & Veatch project team.

Twenty-four interviews were conducted over a 2.5-week period, primarily at Lawrence City Hall. Thirty-five people participated in the interviews. The participants included elected officials, property owners, business owners, neighborhood representatives, environmental groups, higher education representatives, and Lawrence city staff. The respondents were asked a series of questions, including issues to consider in choosing a site; possible amenities at the location; wastewater treatment processes; the wastewater rate structure; growth and the need for the new facility to support that growth. A copy of the questions is attached for reference.

Project Awareness

Each of the interview participants was aware of the recommendation for a second wastewater treatment facility.

Considerations in determining viable sites

Environmental issues were the predominant concerns voiced by interviewees. The three environmental issues primarily addressed were to avoid the Baker Wetlands; avoid historic areas such as the California/Oregon Trail and Blanton's Crossing; and just generally mitigate any negative affects the plant could have on the environment, primarily the Wakarusa River.

Odor was the second most common issue of concern. Respondents recognized that a wastewater treatment facility many times will be surrounded by a noxious odor. In recognition of that, respondents urged that the facility not be placed in such a location that prevailing winds would make the odor permeate the Lawrence community.

A concern for aesthetics was also mentioned. Respondents want to ensure that the plant fits with the environment and is pleasing to the eye.

Finally, the size of the site was of interest. Some respondents believe that enough land should be purchased to allow flexibility in the future. Others believe that a small site and associated design should be pursued.

Respondents said that these issues need to be addressed in order for the facility to be as accepted by the general public as possible. They recognize that in and around Lawrence, there is a very active group concerned about the environment. As well, the siting and construction of the plant will have an obvious affect on growth. Taking these issues into consideration will allow that affect to be a positive one both for current and future residents.

Amenities

There has been some general discussion regarding amenities that could be within the buffer surrounding the water reclamation facility.

Open space and bike/hike and natural trails were by far the most mentioned amenities. Many respondents also thought the facility could provide educational opportunities for students from pre-school age through college. Other suggestions included Frisbee golf, an arboretum, a neighborhood park, a dog park, and sports fields. Some respondents did voice concern about the wisdom of encouraging the general public to visit the area given the facility should be very secure.

If amenities are included in the project scope, the highest level of odor control should be implemented to avoid the public's aversion to utilizing the facilities constructed due to odors.

The majority of the interviewees were willing to pay more in wastewater rates to fund the construction of the selected amenities.

Wastewater Treatment Process

The only group of respondents that considered themselves knowledgeable about wastewater treatment processes was City employees. The other interviewees said they were vaguely familiar with processes and techniques.

Several mentioned a desire to use created wetlands in the process, but recognized that the Kansas environment and the capacity necessary at the facility were not conducive to using wetlands as a treatment process. Some respondents desire a treatment process that required as little land as possible; still others said it was the job of the engineering consultants to determine the appropriate process.

Wastewater Rate Structure

Interviewees were asked about the new wastewater rate structure put into place at the beginning of 2005. While the majority of the participants were aware that there had been changes in the rate structure, very few knew the details of the changes. Nonetheless, many voiced concern about the affect rates had on average homeowners and some were concerned about the affect they had on large water users. Lastly, some respondents believe the City should annually raise rates at lower levels and should consider larger sewer connection fees for new connections for growth to fund more of the infrastructure expansion.

Growth Issues

No one, to a person, was surprised that the City of Lawrence has been growing and might reach a population of 100,000 before 2011. Reasons for their awareness of this growth ranged from understanding that Lawrence's quality of life draws new residents; that the signs of growth are obvious in the new developments around town; and that many multi-family developments have been approved. Many respondents did indicate that what surprised them about this recent community conversation is that the growth apparently came as a surprise to City officials. Those sentiments were followed with suggestions that the city needs to better plan for its growth--in analyzing applications and the affect development has on existing infrastructure and through the construction of new infrastructure before it is needed. . ."to get ahead of the curve."

The final issue interviewees were asked to comment on was whether the city should impose a moratorium on development if additional treatment capacity could not be built. And while not one person was surprised by Lawrence's growth, not one person believed that a moratorium on development would be good for the City in the long run. Respondents believe the City should pursue construction of the water reclamation facility and do what it can to reduce the amount of time necessary for the facility to be operational.

<u>Interviewees</u>

The following individuals were interviewed.

Judy Billings	Bleeding Kansas Heritage Area
Bill Busby	Kansas Biological Survey
John Pendleton	Business Owner
Carey Maynard-Moody	Kansas Sierra Club
Don Dunn	Indian Hills Neighborhood Association
Scott Schultz	Rural Water District No. 4
Ralph King	Property Owner
Sharon Dwyer	Rural Water District No. 5
Fred Six	Property Owner
Ron and Joyce Wolf	Interested Citizens and Jayhawk Audobon Society
Jim Carpenter	Prairie Meadows Neighborhood Association
Melinda Henderson	Prairie Meadows Neighborhood Association
Jim Brewer	Kansas Department of Transportation
Roger Kitsmiller	Property Owner
Don Hatcher	Baker University
Boog Highberger	Mayor
David Schauner	City Commission
Mike Amyx	City Commission
Mike Rundle	City Commission
Sue Hack	City Commission
Administration Staff	
Utilities Staff	
Public Works Staff	
Planning Staff	
Parks Staff	

Stakeholder Interview Questions

The City of Lawrence currently operates the Kaw Wastewater Treatment Plant with an annual average capacity of 12.5 MGD. In 2003, a comprehensive *Wastewater Master Plan* was completed for the City. The Master Plan's evaluation of the current wastewater treatment capacity, the projected growth in wastewater flows, alternative scenarios to convey and treat the increased flows, and pending regulatory changes resulted in the recommendation to construct a second treatment facility along the Wakarusa River.

1. Please share with us your perspective on the need for a second wastewater treatment facility in Lawrence.

2. The City is currently considering an area generally one mile north and one mile south of the Wakarusa River from the Clinton dam to E1900 Road, which is the eastern boundary of the Urban Growth Area.
    a. What do you think should be taken into consideration in determining a viable site within these boundaries?
    b. Why do you think these factors are important to the success of this project?

3. A buffer area is required around the plant and could include: wetlands, ponds, walking trails, green space, or other features.
    a. Of these amenities, which do you prefer?
    b. Do you have any additional suggestions?

4. How familiar are you with wastewater treatment processes?
    a. Is there a process you prefer?
    b. If so, what is it and why?

5. You may have heard or read recently that larger-than-expected growth has taken place in the community? Does this surprise you? Why or why not?

6. In 2005, a new wastewater rate structure was put into place.
    a. What do you know about the rate structure?
    b. What do you think the rate increase is?
    c. Did you know that a rate increase will be needed after 2009 to fund the debt payment, operating costs of the new facility, and other Capital Improvement Plan projects?

7. If a new water reclamation facility were not built, the existing 8th Street Wastewater Treatment Plant can only service a population of 100,000. Based upon Master Plan projections, this population was to occur in 2011, but may be sooner due to accelerated growth that is higher than projected. The consequences of not building a new facility would be a moratorium on new development until additional treatment capacity could be built.
    a. Do these issues concern you, and why?
    b. What do you believe the City's action should be?

BLACK & VEATCH CORPORATION

Ultimate Build-Out Acreage

Lawrence, Kansas
Wakarusa Water Reclamation Facility

B&V Project No. 138563
B&V File B-1.1
January 6, 2006

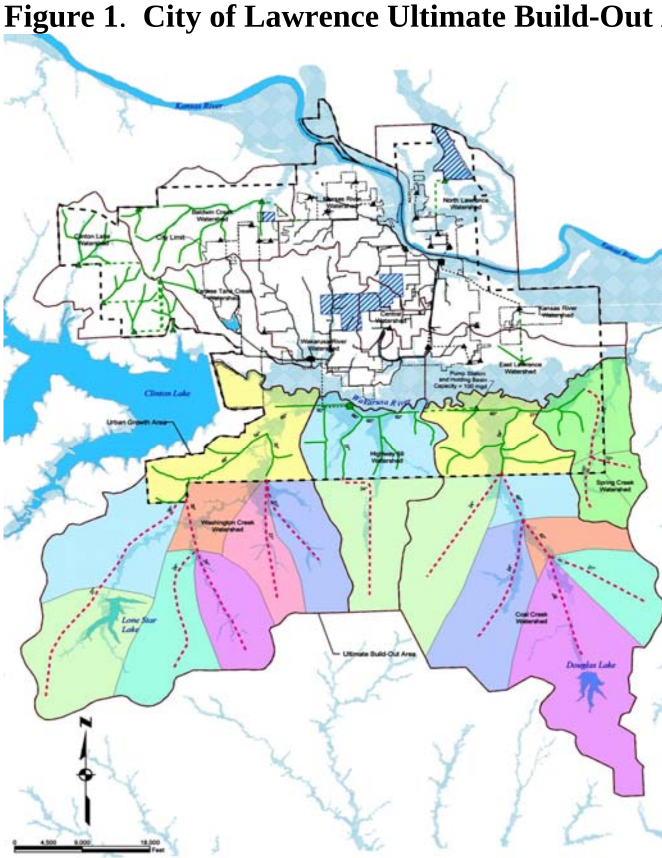
To: Distribution

From: John Keller and Mike Orth

Background

The *2003 Wastewater Master Plan* projected wastewater flows for the City of Lawrence collection and treatment facilities through year 2025. The study area limits for the *Master Plan* were defined as the Urban Growth Area (UGA) as established by the City's *2025 Transportation Plan*. The limits of the UGA are shown on Figure 1. The *Master Plan* estimates the developed area within the UGA to be 25,059 acres out of a total 55,028 acres through year 2025. Extension of the UGA south of the Wakarusa River encompasses the northern portion of Washington Creek, Highway 59, Coal Creek, and Spring Creek watersheds that have the potential to be serviced and contribute flow to the Wakarusa Water Reclamation Facility (WRF).

Figure 1. **City of Lawrence Ultimate Build-Out Area**



The following table illustrates the distribution of area within these watersheds and their relationship to the UGA.

Watershed Areas South of the Wakarusa River			
	Within UGA, acres	**Outside UGA, acres**	**Total Area, acres**
Washington Creek	4,753	23,385	28,138
Highway 59	4,209	4,197	8,406
Coal Creek	3,986	22,236	26,222
Spring Creek	2,105	2,770	4,875
Total	15,053	52,588	67,641

The area outside of the UGA in these watersheds is almost equal to the entire area within the City's planned UGA limits. This additional future service acreage for the ultimate build-out scenario is desired to be considered when siting the new Wakarusa WRF for long-range planning purposes. While treatment capacity is not currently needed for this area, the City of Lawrence desires to consider the spatial needs for the treatment facility to service this area in the future.

With the acreage of this ultimate build-out area defined, a number of methods may be utilized to estimate the treatment capacity needs.

Capacity Determination

Flows to wastewater treatment plants are generally based upon a blend of three components. These components are: residential, commercial, and industrial wastes. Each of these components will contribute in some proportion to the total flow for the new Wakarusa WRF. Typical planning level flow estimates from these components are:

Commercial Flow = 1,000 gallon per acre
Industrial Flow = 1,000 gallons per acre
Flow per capita = 100 gallons per day
Capita = 6 to 12 per gross acre (development highly dependent)

To establish a total ultimate build-out capacity, there are several ways of establishing the flows from the three general areas. These methods are based on past experience and normally accepted practices for developing planning level estimates for the generation of wastewater flows. These approaches are as follows:

Lawrence, Kansas B&V Project No. 138563
Wakarusa Water Reclamation Facility B&V File B-1.1
January 6, 2006

Per Capita Based Projections

This method of projection has historically been utilized for the City's wastewater collection and treatment system sizing where land use and population projections determined wastewater flows.

Generally accepted planning level domestic wastewater generation estimates range from 70 to 100 gallons per capita per day (gpcd). Adding in a blend of commercial and industrial contribution, these projections can typically range from 100 to 150 gpcd or more depending upon the degree of commercial/industrial flows contributing to the system. For comparison purposes the 2003 Wastewater Master Plan utilized 100 gpcd (Reference Table I-18) as Lawrence wastewater flows are primarily driven by the high residential population to commercial/industrial flows.

The density of residential development also plays a significant role in forecasting wastewater flows utilizing this methodology. In past Master Plans, the Lawrence Planning Department has traditionally provided population projections based upon planning years, historical growth rates, and planned land use. The 2003 Wastewater Master Plan utilized a factor of 6.24 people per acre (Reference Table I-18) while the 1995 Master Plan utilized 12 people per acre (Reference Figure VII-1). The difference in the planning density is again driven by time. The 2003 Master Plan primarily evaluated growth outside the urban core into new watersheds, which were initially forecasted by the Planning Department at less density than the existing City. The 1995 Master Plan's focus was more on in-fill, which results in significant differences in population densities. There are development concepts currently being discussed regarding "new urbanism", which results in higher density development in localized areas. Since this memorandum's focus is on ultimate capacity, a range of 6 to 12 people per acre will be utilized for comparison purposes. It should be noted that the "per acre" included in this memorandum is gross acreage and includes right-of-way, parks, green space, and other lands that will not be developed. For comparison purposes, the *2003 Wastewater Master Plan* indicated that the existing wastewater service area density was 4.34 people per acre. (Reference Section I, Paragraph 3.3.1.3)

Therefore, the potential flow range is from 600 gallons per acre (100 gpcd times 6 people/acre) to 1200 gallons per acre (150 gpcd times 12 people/acre).

Spatial Based Projections

Spatial based projections are based upon projected land use and area.

Johnson County Wastewater (JCW) utilizes this method of wastewater projection to size their sewers for new developments. Developments within the new watersheds opened up in recent planning years have been primarily for residential development, but includes contributions for commercial/industrial flows. The minimum total flow per acre based projection, as used by

JCW, is 0.01 cubic feet per second per acre or 6,500 gallons per acre for areas exceeding 3568 acres. This approach includes a wet-weather peaking factor, which is the ratio of wet-weather flows to the average day dry weather flows, of six. The peaking factor is included in collection system sizing to accommodate infiltration and inflow from rain events and high groundwater tables. Treatment plant sizing is based upon dry-weather flows. Therefore, by dividing the 6,500 gallons per acre by 6, the flow rate would be approximately 1,100 gallons per acre.

This methodology has been utilized in Lawrence for the Airport System Collection Study in early year 2000. The area surrounding the airport was projected to be developed as heavy commercial and industrial land use. Therefore, it was determined that a maximum flow rate of 2,200 gallons per acre would be used to determine an ultimate design capacity of the Airport service area. This spatial projection doesn't include a residential component and isn't reflected of the likely land use in the new watersheds. Nonetheless, it was included for comparison purposes to illustrate the impact of land-use planning.

These projections can be benchmarked against other communities that utilize spatial based planning to provide an overall check. Our review validated the projections utilized by JCW as the Metropolitan Council Environmental Services Division for Minneapolis, Minnesota utilizes 800 gallons per acre and Spokane, Washington utilizes 1,000 gallons per acre, which are both within the planning level estimates when correcting for locational factors.

Forecasted Ultimate Treatment Capacities

Using these various approaches, and including the comparison City projections previously summarized, provides a range of possible treatment plant capacities as summarized in the following table.

	Wastewater Projections, mgd					
Total Area Outside UGA, acres	600 gal/acre	800 gal/acre	1,000 gal/acre	1,100 gal/acre	1,200 gal/acre	2,200 gal/acre
52,588	31.6	42.1	52.6	57.8	63.1	115.7

Findings

The use of these various forecasting methodologies provides a wide range of potential treatment capacities for consideration ranging from 30 to 115 mgd. The 115 mgd projection is based upon predominantly commercial/industrial based development and shouldn't be considered further as

Lawrence, Kansas B&V Project No. 138563
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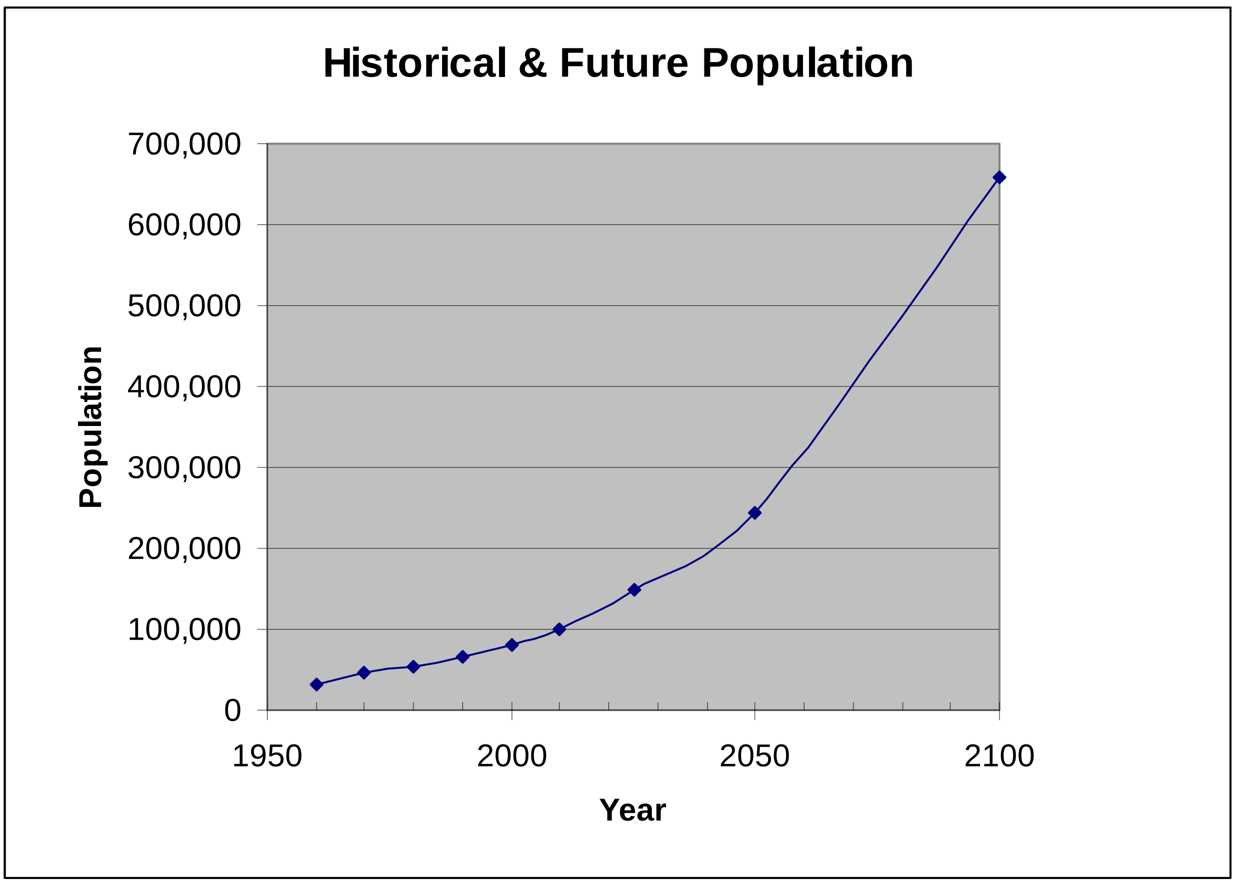
the land use plans developed to-date for the UGA do not support this land use. Therefore, the practical planning estimates supporting a blend of land uses would range from 30 to 65 mgd.

Perhaps further definition can be provided by selecting a planning period and comparing the wastewater projections to future population figures. The following graph is taken from the *2003 Wastewater Master Plan* (Reference Figure I-2) and is based upon historical population data along with forecasted growth. The graph was extended beyond the 2050 point included within the Master Plan at a continued growth rate of 2% to evaluate longer planning periods.



The wastewater flow projections previously determined can also be converted back to a population basis utilizing the 100 to 150 gpcd flows to determine a potential population basis to be served. Comparing those populations to the areas to be developed and the projected population curve previously presented can provide us with density approximations and a planning horizon determination.

	Wastewater Production					
	600 gal/acre	800 gal/acre	1000 gal/acre	1100 gal/acre	1200 gal/acre	2200 gal/acre
Forecasted Treatment Capacity, mgd	31.6	42.1	52.6	57.8	63.1	115.7
Forecasted Population						
@ 100 gpcd	315,528	420,704	525,880	578,468	631,056	1,156,936
@ 150 gpcd	210,352	280,469	350,587	385,645	420,704	771,291
Developed Acres	52,588	52,588	52,588	52,588	52,588	52,588
Density, Persons/acre						
@ 100 gpcd	6.0	8.0	10.0	11.0	12.0	22.0
@ 150 gpcd	4.0	5.3	6.7	7.3	8.0	14.7
Forecasted Capacity Year						
@ 100 gpcd	2072	2085	2095	2100	2103	2131
@ 150 gpcd	2052	2064	2075	2078	2083	2111

Therefore, if a 50 year planning horizon is determined appropriate, the minimum plant capacity that should be contemplated to acquire property for would be approximately 50 mgd (42.1 mgd based upon 800 gal/acre plus the 6.9 mgd of treatment capacity determined from area within the UGA).

This treatment plant determination is based upon the assumptions made herein and may vary based upon actual development conditions.

Lawrence, Kansas
Wakarusa Water Reclamation Facility
Area Bus Tour

Summary
December 14, 2005
3:00 to 4:30 pm

Attendees

Austin Turney – PAC (League of Women Voters)
Tom Bracciano – PAC (USD 497)
Charles Hawkins – PAC (Haskell Indians Nations University)
Rod Geisler – PAC (KDHE)
Roger Pine – PAC (Kansas Legislature)
Michael Bowman – PAC (Interested citizen)
Mary Lynn Stuart – PAC (Lawrence Preservation Alliance)
Mike Caron – PAC (Save the Wakarusa Wetlands)
Laura Calwell – PAC (Friends of the Kaw)

Debbie Van Saun – City
Dave Wagner – City
Lisa Patterson – City
Jeanette Klamm - City
Mike Orth – B&V
John Keller – B&V
Page Surbaugh – B&V
John Pasley – HNTB

Summary

The following descriptions provide a summary of group comments voiced about each of the areas in the order they were visited during the tour. The accompanying map provides an updated representation of the actual tour route as adjusted due to road closures, etc. The map illustrates potential areas of interest and names each site by a color for discussion purposes. Area fields were also updated on the map to better reflect useable areas based upon visual inspection during the tour.

Green Site

- High visibility at K-10 entrance to Lawrence; may require high degree of architectural treatment to make it acceptable.
- Adjacent neighbors may drive high degree of odor control
- K-10 corridor likely to have high commercial/industrial value
- Flat
- All flows south of the river would need to be pumped

- Remote from western growth; would require longest connection to Four Seasons Pumping Station
- Location would provide lowest cost solution for southeast area growth; may be able to flow by gravity.
- Requires two major Wakarusa River crossings
- Large floodplain region would require mitigation
- Location with access to K-10 is positive for truck traffic movement, but being that close to a major route may require additional visual aesthetics
- Downstream of Haskell-Baker Wetlands

Yellow Site

- Some ridges, but portion west of approximately E. 1850 Road fairly flat
- Would need to push close to river due to elevation changes
- Near river within the floodplain, would require mitigation
- Spring Creek Watershed would drain by gravity; flows from Coal Creek, Highway 59, and Washington Creek Watersheds would likely need to be pumped to a plant in this location
- Large floodplain buffer to the north helps address offsite odor concerns
- Proximity to several houses; may require relocation of property owner(s)
- Downstream of Haskell-Baker Wetlands
- Close to southeast area growth; would require pumping
- Remote from Four Seasons Pumping Station

White Site

- Flat, low-lying area
- Floodplain region would require mitigation
- Coal Creek Watershed would drain by gravity; Spring Creek, Highway 59, and Washington Creek Watersheds would require pumping
- Large floodplain buffer to the north helps address offsite odor concerns
- Mostly undeveloped
- Few surrounding neighbors; neighbors are remote from best site option
- Some area roads not maintained by County – people not used to traveling this way which is a benefit due to isolated site
- Tucked-in near river, provides natural buffer
- Some historical artifacts on riverbanks have been found - may require further investigation, but area shouldn't be impacted by construction so not significant issue
- Downstream of Haskell-Baker Wetlands

Blue Site

- Terrain not flat, some hills
- Much of region outside of floodplain, little mitigation would be required
- Prevailing winds may cause an issue over East Lawrence but wide floodplain could help mitigate

Lawrence, Kansas
Wakarusa Water Reclamation Facility
Area Bus Tour

- Many homes in the area
- Highly historical area – Blanton's Crossing and historical farmstead
- Directly south of Haskell-Baker Wetlands
- Requires pumping from both southeast area & Four Seasons Pumping Station
- Spring Creek, Coal Creek, and Washington Creek watersheds require pumping.
- Highway 59 watershed can flow by gravity.

Purple Site

- Fairly flat terrain
- Floodplain region would require mitigation
- Washington Creek and Highway 59 Watersheds would likely drain by gravity; Coal Creek and Spring Creek Watersheds would require pumping
- Prevailing winds could be a problem over Central Lawrence but wide floodplain could help mitigate odor concerns
- Visible from Highway 59/458, access point to City; would require aesthetic treatments to make visually acceptable
- Some neighbors on hill that would overlook facility
- Close connection to Four Seasons Pump Station; location would require shortest forcemain connection to Four Seasons south of river, encouraging western and southern growth
- Location upstream from southeast area; would require pumping
- Upstream of Haskell-Baker Wetlands

Red Site

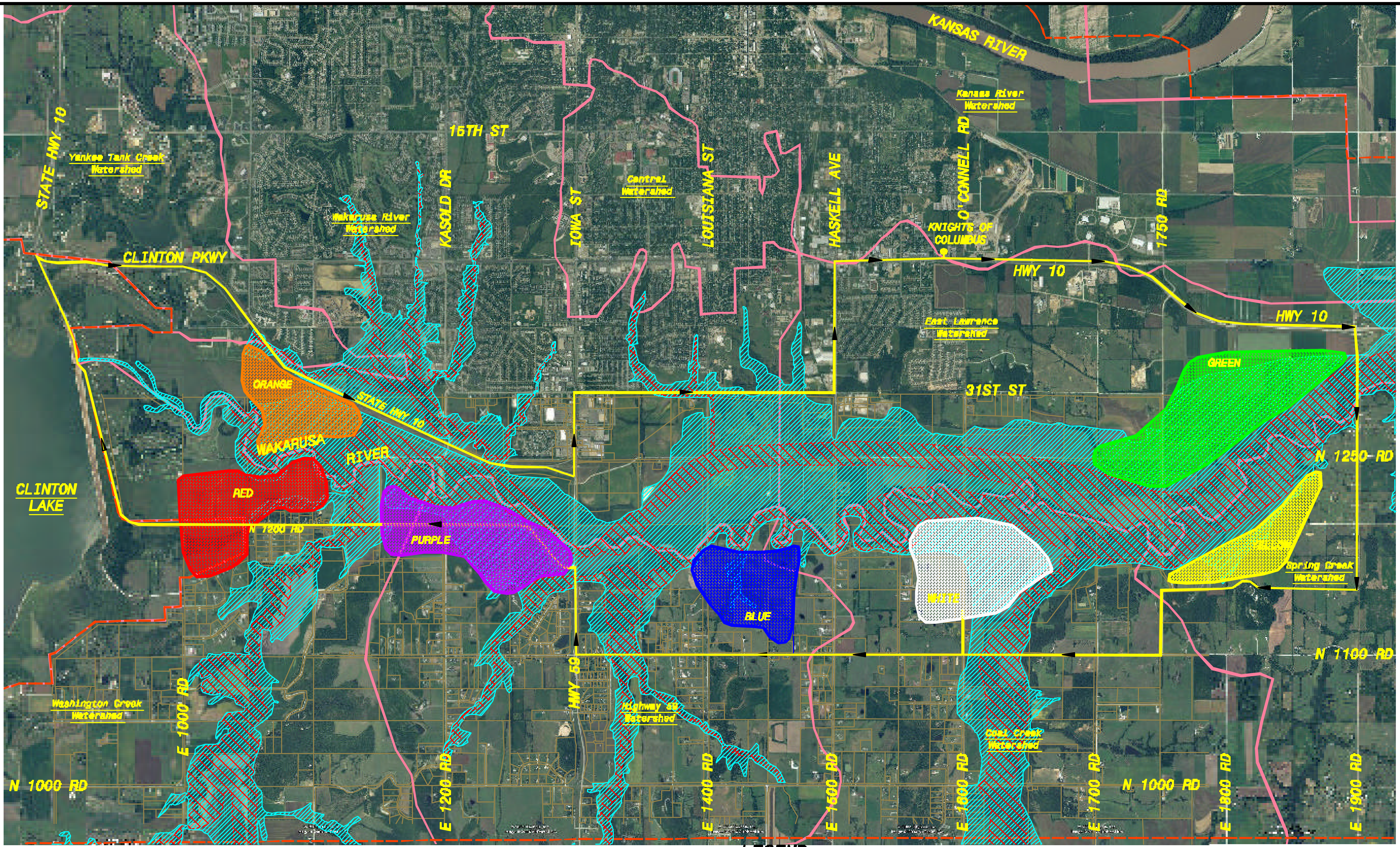
- Fairly flat terrain
- Much of region outside of floodplain, little mitigation would be required
- Much of Washington Creek Watershed would likely drain by gravity; may be too far west to drain all Washington Creek by gravity; flows from Highway 59, Coal Creek., and Spring Creek Watersheds would need to be pumped
- Prevailing winds could be a problem over Central and West Lawrence but wide floodplain could help mitigate
- Close proximity to Clinton Lake
- Marshy land, likely wetlands
- Wetland mitigation area for Clinton Lake would need to be relocated.
- Close connection to Four Seasons Pump Station; location would require short forcemain connection to Four Seasons, which encourages westerly growth
- Location upstream from south east area; would require pumping
- Upstream of Haskell-Baker Wetlands

Orange Site

- Fairly flat
- Prevailing winds could be a problem over Central and West Lawrence; residential housing is fairly close
- Highly visible – close proximity to Clinton Parkway and Highway 10

Lawrence, Kansas
Wakarusa Water Reclamation Facility
Area Bus Tour

- Several near neighbors and ball parks that host national competitions
- Parks and Recreation Master Plan incorporates some of this area
- Lighting less of a concern due to lighting of ballparks
- All flows south of the river would need to be pumped
- Close proximity to Clinton Lake
- Upstream of Haskell-Baker Wetlands
- Shortest connection to Four Seasons Pumping Station; encourages western growth
- Remote from southeast area; would require pumping



LEGEND

APPROX. FLOODPLAIN

APPROX. FLOODWAY

PROPERTY LINE

APPROX. WATERSHED BOUNDARY

APPROX. URBAN GROWTH AREA

4000' 2000' 0 4000'

APPROX. SCALE IN FEET

BLACK & VEATCH Corporation
Kansas City, Missouri

LAWRENCE, KANSAS
WAKARUSA WATER RECLAMATION FACILITY
BLACK & VEATCH
2005

BFIGBORD

BLACK & VEATCH

MEMORANDUM

City of Lawrence	B&V Project 138753
Lawrence, Kansas	B&V File C
Wakarusa Water Reclamation Facility	January 12, 2006

The purpose of this memorandum is to outline the review process that will be conducted at the January 18, 2006 PAC meeting and to describe the three major footprint alternatives considered.

Project team members will be provided with copies of the Preliminary Alternative Attributes and Preliminary Rankings Scorecard which were developed by Black & Veatch with input from our subconsultants based upon our knowledge of the sites, site observations, and a review of available mapping and information. Each PAC member will be provided with a color aerial map depicting the areas considered. The Attributes, Scorecard, and map are color coded by site for quick reference purposes.

Use of Information

The Preliminary Alternative Attributes form provides a definition of the subcriteria considered, along with an abbreviated comment relating to the alternative considered.

The Preliminary Rankings Scorecard graphic represents the scoring to date provided by the City's Consultants. All criteria were evaluated on a scale of 1 to 5, with 1 being the worst score and 5 the best. The scoring is also illustrated by color, with white representing the worst score (1's) and black the best (5's). Shades of gray from lighter to darker are utilized to represent scores between these values. More favorable scoring trends can visually be seen by observing the darker colors for the sites and criteria.

Please be mindful of drawing too early conclusions as these scores are only partial representations of the evaluations as the criteria weight will impact the results, as well as the benefit/cost evaluation that is underway.

Team members in attendance at the PAC meeting will be provided an example of how the rankings were completed and then divided into two groups to review the community and environment scoring, which is subjective. The groups will then be asked to indicate areas of concern that they have with the scoring during a larger group discussion period.

The land, process, and schedule criteria rankings are less subjective issues and the majority of the criteria are evaluated based upon more tangible issues. If time permits, the project team will review these issues with the group or elect to cover them in a separate meeting.

Overview of Alternatives

The main categories of alternatives that will be considered for the Wakarusa Water Reclamation Facility (WRF) will be classified as **small, medium, and large** footprint technologies and will be evaluated at each site. The **small** alternative will utilize small-footprint, high-end treatment processes to provide for a large volume of treatment capacity in a small space. The **medium** alternative will occupy the acreage required for a conventional mechanical plant, similar to the existing Kansas River Wastewater Treatment Plant (WWTP). The **large** alternative will combine the treatment technology represented by the medium footprint alternative, followed by partial wetlands treatment.

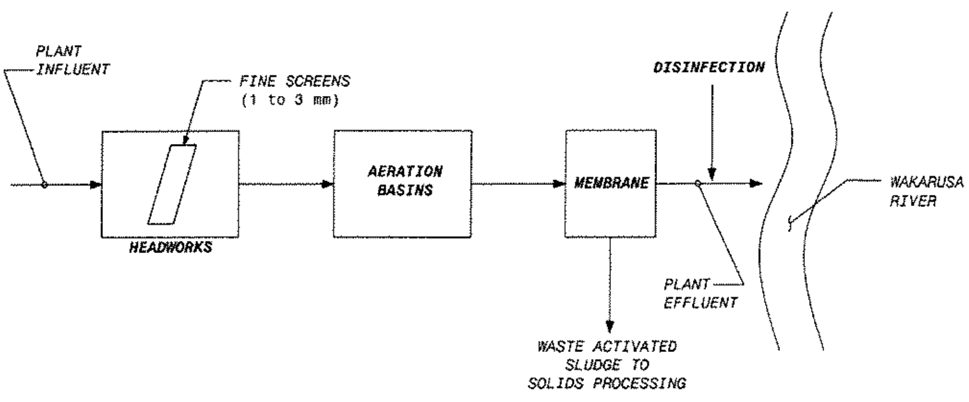
This phase of the project does not include a detailed discussion of process alternatives that fit within each size grouping; the **focus of this phase of the project is to acquire as flexible site as possible that provides options for future process considerations**. The **next phase of this project will evaluate treatment technologies** based upon the actual site(s) selected.

This memorandum also addresses add-on processes that would be common to all alternatives, such as solids dewatering and land application as well as management of wet-weather flow.

Small Footprint Alternative

The small footprint alternative proposed for this project consists of applying a high-end technology process to accomplish the treatment goals. A representative example of a small footprint treatment system is a membrane bioreactor (MBR). This process may consist of the following major elements:

SMALL FOOTPRINT



The headworks would receive the incoming sewage and include a screening process added on with grit removed. Following screening and grit removal, an aeration basin would be require to accommodate the biological processes, followed by the bioreactor. The MBR technology uses submerged hollow fiber membranes to provide a physical separation of contaminants from the wastewater effluent. The membrane separation is far more efficient than clarifiers for settling material and produces a significantly smaller footprint. Following treatment in the MBR, the treated wastewater would go through a disinfection process and then would be suitable for discharge to the Wakarusa River.

Advantages of small alternative footprints may include:

- Less property to acquire due to smaller footprint
- Potentially improved aesthetics
- High-end technology produces high quality, consistent effluent
- Suitable for remote operation

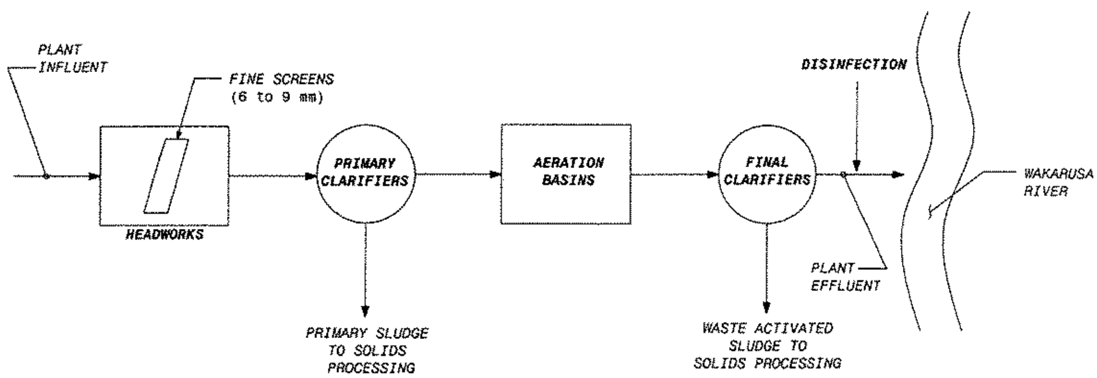
Disadvantages may include:

- Higher capital cost
- Higher operations and maintenance costs
- Energy intensive technology compared to other alternatives
- Reduced ability to handle peak wet weather flows
- Higher level of process controls

Medium Footprint Alternative

The medium alternative proposed for this project consists of a footprint that is similar to the City's existing wastewater treatment plant, which is characterized as a "conventional" mechanical plant. The process may consist of the following major elements:

MEDIUM FOOTPRINT



The headworks would receive the incoming sewage and include a screening process and grit removal. The headworks and grit basin would be followed by a clarifier for settling, followed by aeration basins for the biological processes. Final clarifiers would follow the aeration basins. Chemicals can be added at different points in the process to enhance the settling or treatment efficiencies. The treated wastewater would go through a disinfection process and then would be suitable for discharge to the Wakarusa River.

It should be noted that defining the medium alternative space allocation as similar to that required for a conventional plant does not specify a type of technology, only a spatial need. Other viable technologies, such as an oxidation ditch, Living Machine, or other conventional treatment technologies may be considered.

Advantages of the medium alternative may include:

- Improved handling of peak wet weather flows
- Proven treatment technology
- Operational familiarity by staff
- Process flexibility for future expansions
- Lower installed capital costs
- Lower operational costs
- Consistent quality effluent

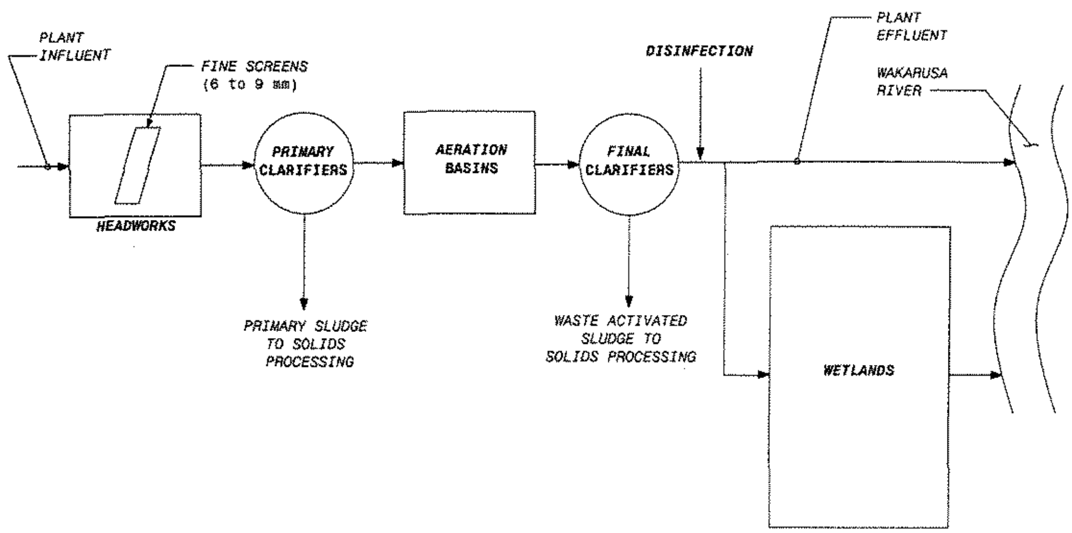
Disadvantages may include:

- Requires more space to accommodate the same volume of treatment
- Increased actual or perceived aesthetics concerns due to the dispersed site layout

Large Alternative Footprint

The large footprint alternative consists of the medium treatment process discussed above with the effluent feeding a wetlands treatment area for polishing the effluent. This process may consist of the following major elements.

LARGE FOOTPRINT



Wetlands technology is attractive because it is the "green solution," capitalizing on nature. The process uses vegetation, soil, and microorganisms to treat influent organic and nutrient components through their naturally occurring processes. The natural processes are much slower and far more dependent upon uncontrollable variables such as temperature than are conventional mechanical plants. As a result, a wetlands treatment system requires a footprint that is 4 to 10 times or more than that required for conventional treatment of the same waste stream. Due to spatial limitations of the areas considered, only a portion of the flow can be treated in the wetlands.

At a minimum, primary treatment must be provided in front of a wetlands treatment system. Wetlands treatment is often viewed positively by the public as a reflection of nature. However, unless some form of secondary treatment is provided upstream of the facility, public access to the facility and surrounding parks, trails, or educational facilities is limited due to health concerns.

In response to treatment area requirements as well as the desire to provide associated public facilities with a wetland treatment system, this alternative provides wetlands treatment downstream of the medium footprint plant alternative, capitalizing on the natural treatment process of the land while assuring public accessibility to the facility.

Advantages of large alternative (conventional plant followed by wetlands) may include:

- Natural solution
- Provides opportunity for public wetlands treatment education
- Improved handling of peak wet weather flows
- Proven treatment technology
- Operational familiarity by staff
- Process flexibility for future expansions
- Potential aesthetic acceptance gained with wetlands

Disadvantages may include:

- Large area required relative to degree of treatment
- Reduced performance during colder weather
- Additional maintenance requirements for wetlands
- Public health concerns with mosquitoes, etc.

Additions To Be Considered For Alternatives

Each alternative discussed above has additional options that when added to the treatment alternative will result in greater acreage required for the site. While these options do impact the treatment area required, their application is separate from the alternative selection. Decisions on the concepts discussed below do not depend on the alternative selected; they are common to all alternatives and should not be part of the alternative selection process.

Wet-Weather Flows

Wastewater collection systems have a high level of infiltration and inflow (I/I) when compared to dry-weather flows. In areas of high groundwater tables and during rain events, the sewer receives a high load of water through collection system openings and infiltration from leaky pipe joints. As a result, the treatment plant is required to handle higher (peak) flows. This is not unique to Lawrence.

While it is true that new collection systems will experience reduced I/I, planning for the peak load during wet weather periods will remain an important considerations as the new Wakarusa facility will be serviced by both new and existing collection system components.

All the alternatives include acreage required for treating 300 mgd (50 mgd ultimate site capacity x 6:1 Peaking Factor as overall system factor) with ballasted flocculation at the treatment sites.

Solids Management

Options for solids management include providing solids treatment followed by land application at the Wakarusa WRF or transporting the solids to the Kansas River WWTP for treatment.

Solids handling at the Wakarusa WRF will require additional space for facilities which may differ based on which treatment method is utilized. The primary issues that may be associated with onsite solids treatment include potential odor and visuals aesthetics impacts. In addition to the solids treatment facilities, acreage for land application of solids will also be required.

Alternatively, solids may be transported and treated at the existing Kansas River WWTP. Issues associated with this option include determining a method of conveyance of the solids from the Wakarusa WRF to the Kansas WWTP and the potential need to expand solids processing facilities at the Kansas WWTP to handle the additional load. Solids would need to be conveyed from the Wakarusa WRF to the Kansas WWTP via the collection system or a dedicated pipeline. Another option would be to utilize trucks to transport the solids; of course, this option would lead to increased truck traffic in the Lawrence area.

If the Wakarusa WRF is to have onsite solids processing and treatment, acreage will need to be added to the land requirements for the facility. Since the objective it to acquire sufficient land, all of the options includes the ability to process 50 mgd of solids on site by adding an additional 20 acres. This does not include an approximated 8000 acres of permitted land application to dispose of the biosolids. This acreage is based upon a rule of thumb multiplier of 3 to account for farmers changing their minds regarding participating in the land application program.

Buffer Area

Wastewater facilities require a buffer area around them to maintain a distance between them and adjacent land owners. The State of Kansas Department of Health and Environment Minimum

Standards of Design for Water Pollution Control Facilities establishes minimum separation requirements. Minimum separation requirements for large treatment facility range from 350 to 1000 feet basted upon proposed or existing habitnats. This distance may be reduced to a minimum of 350 feet with the written permission of the effected property owner(s). The buffer area included in the spatial estimates is based upon 1000 feet on all sides.

Additional Public Facilities

In addition to treatment facilities, the community may decide that they want the Wakarusa WRF to provide additional features for the public's use. These amenities could include one or more of the following:

- Walking/biking trails
- Additional green space
- Educational center
- Wetlands
- Golf course

The additional acreage that will be required by additional public features will be determined based upon the amenity desired. It may be feasible to construct public amenities within the buffer area previously discussed, therefore not requiring the purchase of additional land.

Areas required

In order to determine which sites are most suitable for the Wakarusa WRF, it is important to understand the acreage requirements for each of the footprint alternatives and additions. With this information, the PAC will be able to rate the areas with respect to each of the criteria established by the group.

Estimates of acreage for each of the alternatives, including buffer area and the optional additions are summarized in the table below:

Alternative	Acreage Required
Small	235
Medium	300
Large	1000

The estimate of the acreage needed for the small alternative was determined by scaling previous designs. The acreage for the medium alternative was estimated by evaluating the spatial needs of the City's existing treatment plant. The acreage of the large alternative was developed by adding the estimate developed for the medium alternative with an estimate of wetland area calculated by Dr. Robert Kadlec for partial treatment. These estimates do not include land for the disposal of biosolids or for the mitigation of floodplain impacts.

Community

Aesthetics

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4 Marginally visible from major highway	**5** Not highly visible from major highway	**5** Not highly visible from major highway	**5** Not highly visible from major highway	**2** Highly visible from major highway/gateway to the city	**2** Highly visible from major highway/gateway to the city	**2** Highly visible from major highway/gateway to the city
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2	**3**	**4**	**3**	**1**	**1**	**1**
Location as above, but facility mostly outdoors/larger - rates lower than small						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**5**	**5**	**5**	**2**	**2**	**2**
Location as above, wetland buffer leads to higher rating than medium						

Noise Control

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4 Fewer near neighbors; portions of facility covered	**4** Fewer near neighbors; portions of facility covered	**3** Near neighbors; portions of facility covered	**3** Near neighbors; portions of facility covered	**4** Fewer near neighbors; portions of facility covered	**3** Near neighbors; portions of facility covered	**4** Near ball-field; portions of facility covered
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**3**	**2**	**2**	**3**	**2**	**3**
Neighbors as above; fewer covered portions drops rating below small						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**3**	**3**	**4**	**3**	**4**
Neighbors as above; wetland buffer restores sites to that of the small footprint facility						

Odor Control

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4 Few near neighbors	**1** Valley with plant near property line (based on site topography)	**4** Few near neighbors	**3** Near neighbors	**2** Location bisected by city entrance route	**2** Location bisected by city entrance route	**3** Near ball-field
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**1**	**4**	**3**	**2**	**2**	**3**
Location as above; amount of odor and location of headworks same as for small						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**1**	**4**	**4**	**2**	**2**	**3**
Location as above; wetlands may provide wider buffer on some sites, but amount and location of odor the same as for small						

Prevailing Winds

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2 Northeast wind would impact K-10 corridor	**5** Floodplain provides buffer; northeastern winds should not impact highly populated areas	**5** Floodplain provides buffer; northeastern winds should not impact highly populated areas	**4** Floodplain provides buffer; northeastern winds should not impact highly populated areas, but some near neighbors	**1** Northeastern wind would impact populated areas; narrower floodplain buffer	**2** Northeastern wind would impact populated areas	**1** Northeaster wind would impact populated areas, narrower floodplain buffer
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2	**5**	**5**	**4**	**1**	**2**	**1**
Location dependent, as given above						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2	**5**	**5**	**4**	**1**	**2**	**1**
Location dependent, as given above						

Lighting Control

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4 Few near neighbors	**1** Topography requires plant near property lines	**4** Few near neighbors	**3** Some near neighbors	**2** Gateway to the City	**2** Gateway to the City	**3** Near neighbors, but ball field already lights area to some extent
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2 Few near neighbors	**1** Topography requires plant near property lines	**4** Few near neighbors	**3** Some near neighbors	**2** Gateway to the City	**2** Gateway to the City	**3** Near neighbors, but ball field already lights area to some extent
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3 Few near neighbors	**1** Topography requires plant near property lines	**4** Few near neighbors	**3** Some near neighbors	**2** Gateway to the City	**2** Gateway to the City	**3** Near neighbors, but ball field already lights area to some extent

Traffic Considerations

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4 Good highway access	**1** Poor highway access	**2** Poor highway access	**2** Poor highway access	**4** Good highway access	**4** Good highway access	**4** Good highway access
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**1**	**2**	**2**	**4**	**4**	**4**
Location dependent, as given above						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**1**	**2**	**2**	**4**	**4**	**4**
Location dependent, as given above						

Fit with Current Land Use

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5 Good fit with current vacant/farm use	**3** Current use is vacant/farm/residential – residential use lowers rating	**5** Good fit with current vacant/farm use	**1** Current use is vacant/farm/residential; fairly well developed with residents, significantly lowering rating	**3** Current use is vacant/farming; position at gateway to city lowers rating	**1** Current use is wetlands mitigation for Clinton Reservoir, significantly lowers ranking	**4** Current use is park/residential/farming – residential use lowers rating
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**2**	**4**	**1**	**2**	**1**	**3**
Usage as given above; ratings lowered due to larger size of medium footprint facility						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**2**	**4**	**1**	**2**	**1**	**3**
Usage as given above; ratings same as above due to common conventional facility in medium/large alternatives						

Fit with Future Land Use

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5 Good fit with future use of vacant/farming	**3** Future use is vacant/farming/ residential – future residential use lowers rating in comparison to other sites	**5** Good fit with future use of vacant/farming	**1** Future use is residential – not highly compatible with location of facility	**3** Future use is vacant/farming; position at gateway to city lowers rating	**2** Future use is vacant/farming/ open/park, moving to residential south of N 1200 Rd; Clinton Reservoir mitigation area also lowers rating	**4** Park/residentia l/farming – presence of ball field
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**3**	**5**	**1**	**2**	**1**	**3**
Future land use as above, medium footprint facility is larger and would have a greater impact leading to a lower score						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**2**	**4**	**1**	**2**	**1**	**4**
Future land use as above, larger footprint and wetland buffer provide a trade-off in the rankings for medium and large, depending on site						

School District Boundaries

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2 Site may promote growth within Baldwin School District instead of Lawrence (USD 497) School District	**2** Site may promote growth within Baldwin School District instead of Lawrence (USD 497) School District	**2** Site may promote growth within Baldwin School District instead of Lawrence (USD 497) School District	**3** Central location will likely not impact the balance between Baldwin and Lawrence School Districts	**4** Site may promote growth within Lawrence (USD 497) School District instead of within Baldwin School District	**4** Site may promote growth within Lawrence (USD 497) School District instead of within Baldwin School District	**4** Site may promote growth within Lawrence (USD 497) School District instead of within Baldwin School District
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2	**2**	**2**	**3**	**4**	**4**	**4**
Location dependent, as given above						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2	**2**	**2**	**3**	**4**	**4**	**4**
Location dependent, as given above						

Environment

Stream Impacts

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**5**	**5**	**5**	**5**	**5**	**5**
Technology dependent; small footprint consistently produces the highest quality effluent						
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**4**	**4**	**4**	**4**	**4**
Technology dependent; medium footprint facility is proven by extensive operating history to produce high quality effluent						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**4**	**4**	**4**	**4**	**4**
Technology dependent; performance the same as the medium footprint alternative with additional polishing treatment during certain periods of the year						

Discharge Location

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4 Higher rating based on anticipated public perception of facilities' effluent discharge downstream of the Haskell-Baker Wetlands as a benefit	**4** Higher rating based on anticipated public perception of facilities' effluent discharge downstream of the Haskell-Baker Wetlands as a benefit	**4** Higher rating based on anticipated public perception of facilities' effluent discharge downstream of the Haskell-Baker Wetlands as a benefit	**3** Neutral rating based on anticipated public perception of facilities' effluent discharge directly south of the Haskell-Baker Wetlands	**2** Lower rating based on anticipated public perception of facilities' effluent discharge downstream of the Haskell-Baker Wetlands as a detriment	**2** Lower rating based on anticipated public perception of facilities' effluent discharge downstream of the Haskell-Baker Wetlands as a detriment	**2** Lower rating based on anticipated public perception of facilities' effluent discharge downstream of the Haskell-Baker Wetlands as a detriment
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**4**	**3**	**2**	**2**	**2**
Location dependent, as given above						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**4**	**3**	**2**	**2**	**2**
Location dependent, as given above						

Rare or Endangered Species Impacts

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**5**	**5**	**5**	**5**	**5**	**5**
Footprint dependent in the absence of detailed site specific information (will be gathered in Phase II); smaller footprint rated higher due to lesser space requirements and perceived lower impact						
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2	**2**	**2**	**2**	**2**	**2**	**2**
Footprint dependent in the absence of detailed site specific information (will be gathered in Phase II); medium footprint rated lower than small due to greater space requirements and perceived greater impact						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**4**	**4**	**4**	**4**	**4**
Footprint dependent in the absence of detailed site specific information (will be gathered in Phase II); large footprint rated lower than small due to greater space requirements, but higher than medium footprint because wetland buffer creates a permanent environment for species around the facility						

Archeological/Historical Evidence

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5 No known historical resources present; on-site investigation required to confirm	**5** No known historical resources present; on-site investigation required to confirm	**4** Some historical resources identified on riverbank; on-site investigation required to confirm	**1** Confirmed highly historical area	**5** No known historical resources present; on-site investigation required to confirm	**5** No known historical resources present; on-site investigation required to confirm	**5** No known historical resources present; on-site investigation required to confirm
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**3**	**1**	**4**	**4**	**4**
Location dependent; medium footprint rated lower than small due to greater spatial impact						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**3**	**2**	**1**	**3**	**3**	**3**
Location dependent; larger footprint rated lower than medium due to greater spatial impact						

Existing Floodplain/Wetlands Impacts

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3 Neutral rating due to moderate floodplain impacts	**5** High rating due to minimal floodplain impacts	**3** Neutral rating due to moderate floodplain impacts	**5** High rating due to minimal floodplain impacts	**3** Neutral rating due to moderate floodplain impacts	**1** Low rating due to significant impacts to Clinton Reservoir wetland mitigation area	**3** Neutral rating due to moderate floodplain impacts
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
1	**3**	**1**	**3**	**1**	**1**	**1**
Location dependent; medium footprint rated lower than small due to greater spatial impact						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**5**	**3**	**5**	**3**	**1**	**3**
Location dependent, ratings equal to those for small footprint because even though spatial impact is greater for large footprint than for small or medium site, a portion of the site will permanently set aside for wetlands cultivation						

Biodiversity

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**5**	**5**	**5**	**5**	**5**	**5**
Footprint dependent in the absence of detailed site specific information (will be gathered in Phase II); smaller footprint rated higher due to lesser space requirements and perceived lower impact						
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2	**2**	**2**	**2**	**2**	**2**	**2**
Footprint dependent in the absence of detailed site specific information (will be gathered in Phase II); medium footprint rated lower than small due to greater space requirements and perceived greater impact						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**4**	**4**	**4**	**4**	**4**
Footprint dependent in the absence of detailed site specific information (will be gathered in Phase II); large footprint rated lower than small due to greater space requirements, but higher than medium footprint because wetland buffer creates a permanent environment for species around the facility						

Land

Displacement of Housing

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5 No homes on site	**4** 1 home on site	**5** No homes on site	**5** No homes on site	**4** 2 homes on site	**4** 1 home on site	**5** No homes on site
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5 No homes on site	**4** 2 homes on site	**4** 3 homes on site	**4** 3 homes on site	**1** More than 10 homes on site	**4** 2 homes on site	**5** No homes on site
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**1**	**1**	**1**	**1**	**1**	**5**
No homes on site	More than 10 homes on site	More than 10 homes on site	More than 10 homes on site	More than 10 homes on site	More than 10 homes on site	No homes on site

Future Service Area by Gravity

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
1 Can service southeast area	**4** Potential of 30,000 acres	**3** Potential of 25,000 acres	**2** Potential of 8,000 acres	**5** Potential of 36,000 acres	**4** Potential of 28,000 acres	**1** Can service northwest area
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
Can service southeast area	**4**	**3**	**2**	**5**	**4**	Can service northwest area
Location dependent; potential gravity service acreage does not depend on size of facility, but position within the watershed						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
Can service southeast area	**4**	**3**	**2**	**5**	**4**	Can service northwest area
Location dependent; potential gravity service acreage does not depend on size of facility, but position within the watershed						

Usability/Shape

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5 High rating due to flexibility of site	**2** Long and skinny site reduces rating	**5** High rating due to flexibility of site	**1** Historical resources in the area decrease the usability of the site	**5** High rating due to flexibility of site	**3** Lower ranking due to less flexibility than some of the sites; relocation of highway likely required	**4** Lower ranking due to less flexibility than some of the sites
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5 High rating due to flexibility of site – even for larger footprint	**1** Flexibility of long and skinny site is further reduced for larger footprint	**5** High rating due to flexibility of site – even greater for larger footprint	**1** Historical resources in the area decrease the usability of the site – even greater for larger footprint	**2** Highway bisects site for larger footprint – likely to require facility to be shifted south of N 1200 Rd	**1** Highway bisects site; larger footprint to definitely require relocation of the highway	**3** Flexibility for this site is further reduced by larger footprint
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**1**	**3**	**1**	**1**	**1**	**2**
High rating due to flexibility of site – even for large footprint	Flexibility of long and skinny site is even further reduced for large footprint	Flexibility of this site is further reduced by large footprint	Historical resources in the area decrease the usability of the site – even greater for larger footprint	Highway bisects site for larger footprint – likely to require facility to be shifted south of N 1200 Rd; would require extensive displacement of homes	Highway bisects site; large footprint to definitely require relocation of the highway	Flexibility for this site is further reduced by large footprint

Maximizes Use of Existing Infrastructure

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3 Closer to existing WWTP to allow flexibility in solids management, but further from connection point to existing collection system	**3** Closer to existing WWTP to allow flexibility in solids management, but further from connection point to existing collection system	**4** Rated higher due to more centralized location; offers proximity to existing plant and collection system	**4** Rated higher due to more centralized location; offers proximity to existing plant and collection system	**3** Further from existing WWTP reducing flexibility in solids management, but closer to connection point to existing collection system	**3** Further from existing WWTP reducing flexibility in solids management, but closer to connection point to existing collection system	**3** Further from existing WWTP reducing flexibility in solids management, but closer to connection point to existing collection system
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**3**	**4**	**4**	**3**	**3**	**3**
Location dependent; site footprint does not influence the proximity/utilization of existing infrastructure						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**3**	**4**	**4**	**3**	**3**	**3**
Location dependent; site footprint does not influence the proximity/utilization of existing infrastructure						

Process

Proven Treatment Technology

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**3**	**3**	**3**	**3**	**3**	**3**
Process technology, not site location, dependent; while proven, small footprint technology has fewer installations (none in Kansas)						
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**5**	**5**	**5**	**5**	**5**	**5**
Process technology, not site location, dependent; many operational installations and a highly proven technology						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**4**	**4**	**4**	**4**	**4**
Process technology, not site location, dependent; conventional portion of treatment highly proven, but wetlands components introduces additional uncertainty						

Future Regulatory Compliance

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**5**	**5**	**5**	**5**	**5**	**5**
Process technology, not site location, dependent; small footprint technology is able to meet envisioned future regulations						
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**3**	**3**	**3**	**3**	**3**	**3**
Process technology, not site location, dependent; medium footprint technology likely to require new processes to meet future regulations						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2	**2**	**2**	**2**	**2**	**2**	**2**
Process technology, not site location, dependent; similar to the conventional technology, large footprint technology is likely to require new processes to meet future regulations. However, the wetlands component adds an element of uncertainty, causing the large footprint to be rated lower than the medium.						

Operations and Maintenance

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**3**	**3**	**3**	**3**	**3**	**3**
Process technology, not site location, dependent; small footprint technology was ranked lower because it is an unfamiliar process for the City. Also, the process is highly automated and mechanical, typically requiring more maintenance efforts.						
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**5**	**5**	**5**	**5**	**5**	**5**
Process technology, not site location, dependent; conventional technology is familiar for City personnel, leading to efficiencies in O&M						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**3**	**3**	**3**	**3**	**3**	**3**
Process technology, not site location, dependent; conventional portion of technology is familiar, but the wetlands provides a less familiar process component requiring additional O&M outside the expertise of plant operations personnel (for example horticulturists, etc.)						

Expandability

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**5**	**5**	**5**	**5**	**5**	**5**
Process technology, not site location, dependent; small footprint is more modular allowing highly flexible expansion options						
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**4**	**4**	**4**	**4**	**4**
Process technology, not site location, dependent; conventional technology must expand in finite increments, resulting in less flexibility and a lower rating						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**1**	**1**	**1**	**1**	**1**	**1**
Process technology, not site location, dependent; large footprint technology is ranked lower than medium due to greater space requirements for expansion of wetlands. The majority of large footprint sites are ranked at the bottom of the range because the sites simply do not provide enough space to allow for expansion beyond the already large footprint						

Schedule

Land Acquisition

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4 Approximately 2 property owners	**5** Approximately 1 property owner; fewer negotiations	**4** Approximately 3 property owners	**4** Approximately 2 property owners	**4** Approximately 1 property owner	**4** Approximately 2 property owners	**5** Approximately 1 property owner; fewer negotiations
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3 Approximately 4 property owners	**4** Approximately 3 property owners	**3** Approximately 5 property owners	**3** Approximately 5 property owners	**4** Approximately 2 property owners	**4** Approximately 2 property owners	**5** Approximately 1 property owners
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
1	**1**	**1**	**1**	**1**	**1**	**1**
More than 10 owners, ranked low due to large number of negotiations necessary	More than 10 owners, ranked low due to large number of negotiations necessary	More than 10 owners, ranked low due to large number of negotiations necessary	More than 10 owners, ranked low due to large number of negotiations necessary	More than 10 owners, ranked low due to large number of negotiations necessary	More than 10 owners, ranked low due to large number of negotiations necessary	Not enough land available

Permitting

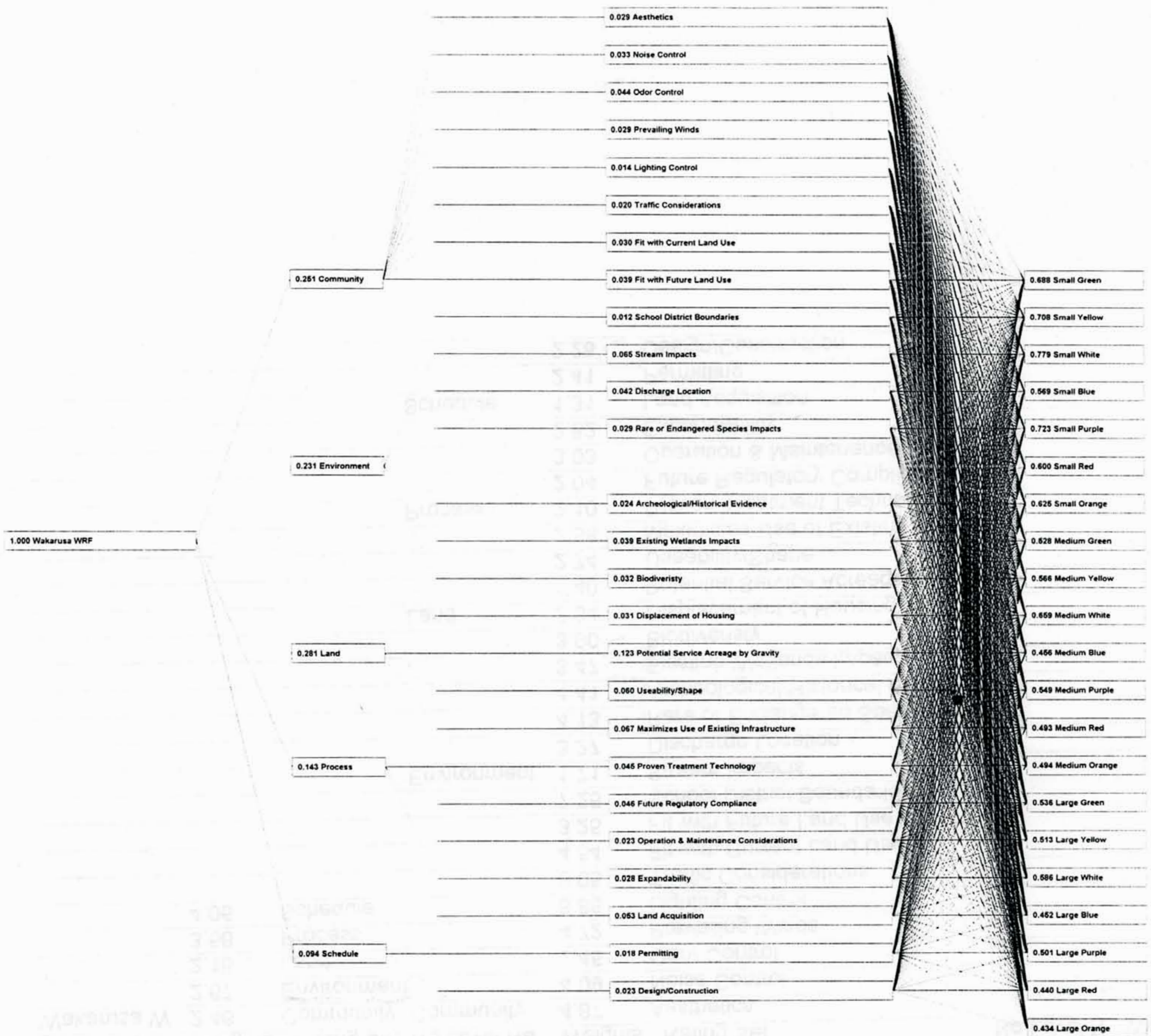
Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4 No installations of small footprint technology in Kansas at this time; will require floodplain mitigation	**5** No installations of small footprint technology in Kansas at this time	**4** No installations of small footprint technology in Kansas at this time; will require floodplain mitigation	**1** Ranked low due to the presence of historical resources on site	**4** No installations of small footprint technology in Kansas at this time; will require floodplain mitigation	**1** Ranked low due to the presence of the Clinton Reservoir wetland mitigation area	**4** No installations of small footprint technology in Kansas at this time; will require floodplain mitigation
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4 Will require floodplain mitigation	**5** No floodplain mitigation required	**4** Will require floodplain mitigation	**1** Ranked low due to the presence of historical resources on site	**4** Will require floodplain mitigation	**1** Ranked low due to the presence of the Clinton Reservoir wetland mitigation area	**4** Will require floodplain mitigation

Permitting (continued)

Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**4**	**3**	**1**	**3**	**3**	**4**
Ranking lowered from that for medium or small footprint due to significantly increased acreage to permit; wetlands component is less familiar to permit	Ranking lowered from that for medium or small footprint due to significantly increased acreage to permit; wetlands component is less familiar to permit	Ranking lowered from that for medium or small footprint due to significantly increased acreage to permit; wetlands component is less familiar to permit	Ranked low due to the presence of historical resources on site	Ranking lowered from that for medium or small footprint due to significantly increased acreage to permit; wetlands component is less familiar to permit	Ranking for large footprint facility at this site is higher than for other footprints since a portion of the site will be set aside permanently for wetlands cultivation	Ranking lowered from that for medium or small footprint due to significantly increased acreage to permit; wetlands component is less familiar to permit

Design/Construction

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
1	**1**	**1**	**1**	**1**	**1**	**1**
Primarily process technology driven; small footprint is ranked low due to need for less efficient, compact construction						
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**5**	**5**	**5**	**5**	**5**	**5**
Primarily process technology driven; medium footprint is ranked highest due more disperse construction						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**3**	**3**	**3**	**3**	**3**	**3**
Primarily process driven; large footprint ranked lower than medium footprint due to additional effort and time it takes to establish the wetlands portion						



1.000 Wakarusa WRF
0.251 Community
0.231 Environment
0.281 Land
0.143 Process
0.094 Schedule
0.029 Aesthetics
0.033 Noise Control
0.044 Odor Control
0.029 Prevailing Winds
0.014 Lighting Control
0.020 Traffic Considerations
0.030 Fit with Current Land Use
0.039 Fit with Future Land Use
0.012 School District Boundaries
0.065 Stream Impacts
0.042 Discharge Location
0.029 Rare or Endangered Species Impacts
0.024 Archeological/Historical Evidence
0.039 Existing Wetlands Impacts
0.032 Biodiveristy
0.031 Displacement of Housing
0.123 Potential Service Acreage by Gravity
0.060 Useability/Shape
0.067 Maximizes Use of Existing Infrastructure
0.045 Proven Treatment Technology
0.046 Future Regulatory Compliance
0.023 Operation & Maintenance Considerations
0.028 Expandability
0.063 Land Acquisition
0.018 Permitting
0.023 Design/Construction
0.688 Small Green
0.708 Small Yellow
0.779 Small White
0.569 Small Blue
0.723 Small Purple
0.600 Small Red
0.625 Small Orange
0.628 Medium Green
0.566 Medium Yellow
0.659 Medium White
0.456 Medium Blue
0.549 Medium Purple
0.493 Medium Red
0.494 Medium Orange
0.536 Large Green
0.513 Large Yellow
0.586 Large White
0.452 Large Blue
0.501 Large Purple
0.440 Large Red
0.434 Large Orange

Goal Level	Weights	Rating Set	No Level Na	Weights	Rating Set	No Level N	Weights	Rating Set
Wakarusa W	2.46	Community	Community	4.67	Aesthetics			
	2.67	Environment		4.09	Noise Control			
	2.16	Land		2.45	Odor Control			
	3.56	Process		4.72	Prevailing Winds			
	4.05	Schedule		6.86	Lighting Control			
				6.05	Traffic Considerations			
				4.54	Fit with Current Land Use			
				3.25	Fit with Future Land Use			
				7.25	School District Boundaries			
			Environment	1.71	Stream Impacts			
				3.27	Discharge Location			
				4.13	Rare or Endangered Species Im			
				4.41	Archeological/Historical Evidence			
				3.47	Existing Wetlands Impacts			
				3.90	Biodiveristy			
			Land	3.34	Displacement of Housing			
				1.40	Potential Service Acreage by Gr			
				2.74	Useability/Shape			
				2.58	Maximizes Use of Existing Infra			
			Process	2.10	Proven Treatment Technology			
				2.04	Future Regulatory Compliance			
				3.03	Operation & Maintenance Consi			
				2.82	Expandability			
			Schedule	1.31	Land Acquisition			
				2.41	Permitting			
				2.28	Design/Construction			

Attributes	Small Green	Small Yellow	Small White	Small Blue	Small Purple	Small Red	Small Oran	Medium Gre
Aesthetics	4.00	5.00	5.00	5.00	2.00	2.00	2.00	2.00
Noise Control	4.00	4.00	3.00	3.00	4.00	3.00	4.00	3.00
Odor Control	4.00	1.00	4.00	3.00	2.00	2.00	3.00	4.00
Prevailing Winds	2.00	5.00	5.00	4.00	1.00	2.00	1.00	2.00
Lighting Control	4.00	1.00	4.00	3.00	2.00	2.00	3.00	2.00
Traffic Considerations	4.00	1.00	2.00	2.00	4.00	4.00	4.00	4.00
Fit with Current Land Use	5.00	3.00	5.00	1.00	3.00	1.00	4.00	4.00
Fit with Future Land Use	5.00	3.00	5.00	1.00	3.00	2.00	4.00	4.00
School District Boundaries	2.00	2.00	2.00	3.00	4.00	4.00	4.00	2.00
Stream Impacts	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00
Discharge Location	4.00	4.00	4.00	3.00	2.00	2.00	2.00	4.00
Rare or Endangered Species Im	5.00	5.00	5.00	5.00	5.00	5.00	5.00	2.00
Archeological/Historical Evidence	5.00	5.00	4.00	1.00	5.00	5.00	5.00	4.00
Existing Wetlands Impacts	3.00	5.00	3.00	5.00	3.00	1.00	3.00	1.00
Biodiveristy	5.00	5.00	5.00	5.00	5.00	5.00	5.00	2.00
Displacement of Housing	4.00	4.00	5.00	4.00	4.00	4.00	5.00	2.00
Potential Service Acreage by Gr	1.00	4.00	3.00	2.00	5.00	4.00	1.00	1.00
Useability/Shape	5.00	2.00	5.00	1.00	5.00	3.00	4.00	5.00
Maximizes Use of Existing Infra	3.00	3.00	4.00	4.00	3.00	3.00	3.00	3.00
Proven Treatment Technology	3.00	3.00	3.00	3.00	3.00	3.00	3.00	5.00
Future Regulatory Compliance	5.00	5.00	5.00	5.00	5.00	5.00	5.00	3.00
Operation & Maintenance Consi	3.00	3.00	3.00	3.00	3.00	3.00	3.00	5.00
Expandability	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00
Land Acquisition	4.00	5.00	4.00	4.00	5.00	4.00	5.00	3.00
Permitting	4.00	5.00	4.00	1.00	4.00	3.00	4.00	4.00
Design/Construction	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00

Medium Yellow	Medium Whi	Medium Blue	Medium Purp	Medium Red	Medium Oran	Large Green	Large Yellow	Large White	Large Blue	Large Purple
3.00	4.00	3.00	1.00	1.00	1.00	4.00	5.00	5.00	5.00	2.00
3.00	2.00	2.00	3.00	2.00	3.00	4.00	4.00	3.00	3.00	4.00
1.00	4.00	3.00	2.00	2.00	3.00	4.00	1.00	4.00	4.00	2.00
5.00	5.00	4.00	1.00	2.00	1.00	2.00	5.00	5.00	4.00	1.00
1.00	4.00	3.00	2.00	2.00	3.00	3.00	1.00	4.00	3.00	2.00
1.00	2.00	2.00	4.00	4.00	4.00	4.00	1.00	2.00	2.00	4.00
2.00	4.00	1.00	2.00	1.00	3.00	4.00	2.00	4.00	1.00	2.00
3.00	5.00	1.00	2.00	1.00	3.00	4.00	2.00	4.00	1.00	2.00
2.00	2.00	3.00	4.00	4.00	4.00	2.00	2.00	2.00	3.00	4.00
4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
4.00	4.00	3.00	2.00	2.00	2.00	4.00	4.00	4.00	3.00	2.00
2.00	2.00	2.00	2.00	2.00	2.00	4.00	4.00	4.00	4.00	4.00
4.00	3.00	1.00	4.00	4.00	4.00	3.00	3.00	2.00	1.00	3.00
3.00	1.00	3.00	1.00	1.00	1.00	3.00	5.00	3.00	5.00	3.00
2.00	2.00	2.00	2.00	2.00	2.00	4.00	4.00	4.00	4.00	4.00
4.00	5.00	4.00	4.00	5.00	5.00	4.00	4.00	5.00	4.00	4.00
4.00	3.00	2.00	5.00	4.00	1.00	1.00	4.00	3.00	2.00	5.00
1.00	5.00	1.00	2.00	1.00	3.00	5.00	1.00	3.00	1.00	1.00
3.00	4.00	4.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	3.00
5.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00
3.00	3.00	3.00	3.00	3.00	3.00	2.00	2.00	2.00	2.00	2.00
5.00	5.00	5.00	5.00	5.00	5.00	3.00	3.00	3.00	3.00	3.00
4.00	4.00	4.00	4.00	4.00	4.00	3.00	1.00	1.00	1.00	1.00
4.00	3.00	3.00	4.00	4.00	5.00	1.00	1.00	1.00	1.00	2.00
5.00	4.00	1.00	4.00	4.00	4.00	3.00	3.00	3.00	1.00	3.00
5.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00

Large Red	Large Orange
2.00	2.00
3.00	4.00
2.00	3.00
2.00	1.00
2.00	3.00
4.00	4.00
1.00	3.00
1.00	4.00
4.00	4.00
4.00	4.00
2.00	2.00
4.00	4.00
3.00	3.00
1.00	3.00
4.00	4.00
5.00	5.00
4.00	1.00
1.00	2.00
3.00	3.00
4.00	4.00
2.00	2.00
3.00	3.00
1.00	1.00
2.00	1.00
3.00	4.00
4.00	4.00

MODEL: Page
Notes:
Criterium Decision Plus
Model Methodology: Simple MultiAttribute Rating Technique

GOAL LEVEL:
Wakarusa WRF

LEVEL 2:
Wakarusa WRF:Community
Wakarusa WRF:Environment
Wakarusa WRF:Land
Wakarusa WRF:Process
Wakarusa WRF:Schedule

LEVEL 3:

LEVEL 4:
Wakarusa WRF:Aesthetics
Wakarusa WRF:Noise Control
Wakarusa WRF:Odor Control
Wakarusa WRF:Prevailing Winds
Wakarusa WRF:Lighting Control
Wakarusa WRF:Traffic Considerations
Wakarusa WRF:Fit with Current Land Use
Wakarusa WRF:Fit with Future Land Use
Wakarusa WRF:School District Boundaries
Wakarusa WRF:Stream Impacts
Wakarusa WRF:Discharge Location
Wakarusa WRF:Rare or Endangered Species Impacts
Wakarusa WRF:Archeological/Historical Evidence
Wakarusa WRF:Existing Wetlands Impacts
Wakarusa WRF:Biodiveristy
Wakarusa WRF:Displacement of Housing
Wakarusa WRF:Potential Service Acreage by Gravity
Wakarusa WRF:Useability/Shape
Wakarusa WRF:Maximizes Use of Existing Infrastructure
Wakarusa WRF:Proven Treatment Technology
Wakarusa WRF:Future Regulatory Compliance
Wakarusa WRF:Operation & Maintenance Considerations
Wakarusa WRF:Expandability
Wakarusa WRF:Land Acquisition

Wakarusa WRF:Permitting
Wakarusa WRF:Design/Construction

ALTERNATIVES:
Small Green
Small Yellow
Small White
Small Blue
Small Purple
Small Red
Small Orange
Medium Green
Medium Yellow
Medium White
Medium Blue
Medium Purple
Medium Red
Medium Orange
Large Green
Large Yellow
Large White
Large Blue
Large Purple
Large Red
Large Orange

Alternatives	Value	Decision Scores
Small Green	0.688	
Small Yellow	0.708	
Small White	0.779	
Small Blue	0.569	
Small Purple	0.723	
Small Red	0.600	
Small Orange	0.625	
Medium Green	0.528	
Medium Yellow	0.566	
Medium White	0.659	
Medium Blue	0.456	
Medium Purple	0.549	
Medium Red	0.493	
Medium Orange	0.494	
Large Green	0.536	
Large Yellow	0.513	
Large White	0.586	
Large Blue	0.452	
Large Purple	0.501	
Large Red	0.440	
Large Orange	0.434	

Attribute	Small Green	Small Yellow	Small White	Small Blue	Small Purple	Small Red
Stream Impacts	1.000	1.000	1.000	1.000	1.000	1.000
Future Regulatory Compliance	1.000	1.000	1.000	1.000	1.000	1.000
Lighting Control	0.750	0.000	0.750	0.500	0.250	0.250
Proven Treatment Technology	0.500	0.500	0.500	0.500	0.500	0.500
Noise Control	0.750	0.750	0.500	0.500	0.750	0.500
Traffic Considerations	0.750	0.000	0.250	0.250	0.750	0.750
Expandability	1.000	1.000	1.000	1.000	1.000	1.000
Fit with Current Land Use	1.000	0.500	1.000	0.000	0.500	0.000
Aesthetics	0.750	1.000	1.000	1.000	0.250	0.250
Maximizes Use of Existing Infrastructure	0.500	0.500	0.750	0.750	0.500	0.500
Odor Control	0.750	0.000	0.750	0.500	0.250	0.250
Fit with Future Land Use	1.000	0.500	1.000	0.000	0.500	0.250
Displacement of Housing	0.750	0.750	1.000	0.750	0.750	0.750
Biodiveristy	1.000	1.000	1.000	1.000	1.000	1.000
School District Boundaries	0.250	0.250	0.250	0.500	0.750	0.750
Rare or Endangered Species Impacts	1.000	1.000	1.000	1.000	1.000	1.000
Useability/Shape	1.000	0.250	1.000	0.000	1.000	0.500
Potential Service Acreage by Gravity	0.000	0.750	0.500	0.250	1.000	0.750
Operation & Maintenance Consideratio	0.500	0.500	0.500	0.500	0.500	0.500
Existing Wetlands Impacts	0.500	1.000	0.500	1.000	0.500	0.000
Discharge Location	0.750	0.750	0.750	0.500	0.250	0.250
Archeological/Historical Evidence	1.000	1.000	0.750	0.000	1.000	1.000
Prevailing Winds	0.250	1.000	1.000	0.750	0.000	0.250
Design/Construction	1.000	1.000	1.000	1.000	1.000	1.000
Land Acquisition	0.750	1.000	0.750	0.750	1.000	0.750
Permitting	0.750	1.000	0.750	0.000	0.750	0.500
Results	0.688	0.708	0.779	0.569	0.723	0.600
Uncertainties	Large Green	Small Green	Medium Green	Small Yellow	Small White	Small Blue
5 percentile	0.531	0.660	0.525	0.705	0.775	0.565
mean	0.536	0.660	0.525	0.705	0.775	0.565

95 percentile	0.541	0.660	0.525	0.705	0.775	0.565
pairwise	0%	0%	0%	0%	50%	0%
absolute	0%	0%	0%	0%	100%	0%

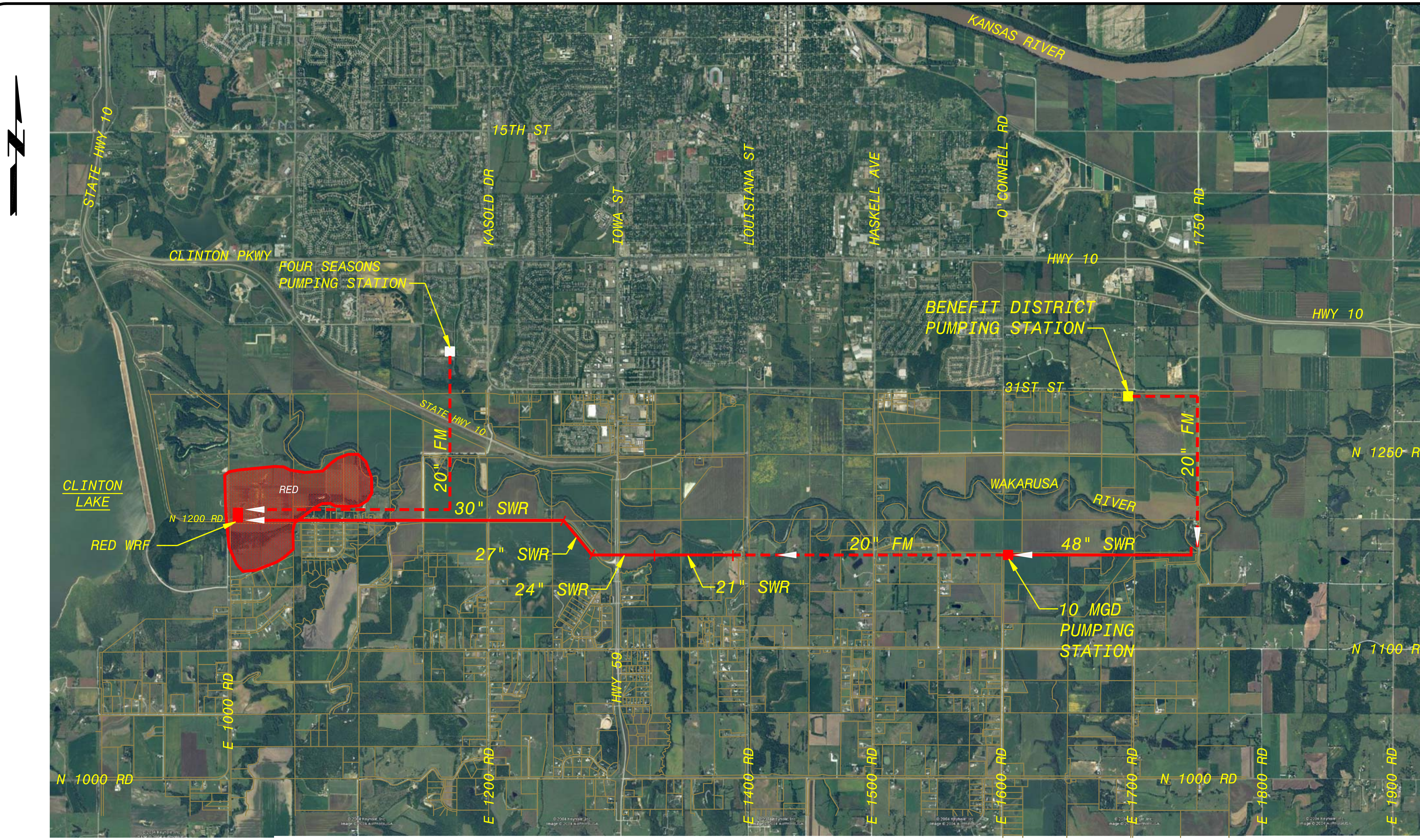
Small Orange	Medium Green	Medium Yellow	Medium White	Medium Blue	Medium Purple	Medium Red	Medium Orange
1.000	0.750	0.750	0.750	0.750	0.750	0.750	0.750
1.000	0.500	0.500	0.500	0.500	0.500	0.500	0.500
0.500	0.250	0.000	0.750	0.500	0.250	0.250	0.500
0.500	1.000	1.000	1.000	1.000	1.000	1.000	1.000
0.750	0.500	0.500	0.250	0.250	0.500	0.250	0.500
0.750	0.750	0.000	0.250	0.250	0.750	0.750	0.750
1.000	0.750	0.750	0.750	0.750	0.750	0.750	0.750
0.750	0.750	0.250	0.750	0.000	0.250	0.000	0.500
0.250	0.250	0.500	0.750	0.500	0.000	0.000	0.000
0.500	0.500	0.500	0.750	0.750	0.500	0.500	0.500
0.500	0.750	0.000	0.750	0.500	0.250	0.250	0.500
0.750	0.750	0.500	1.000	0.000	0.250	0.000	0.500
1.000	0.250	0.750	1.000	0.750	0.750	1.000	1.000
1.000	0.250	0.250	0.250	0.250	0.250	0.250	0.250
0.750	0.250	0.250	0.250	0.500	0.750	0.750	0.750
1.000	0.250	0.250	0.250	0.250	0.250	0.250	0.250
0.750	1.000	0.000	1.000	0.000	0.250	0.000	0.500
0.000	0.000	0.750	0.500	0.250	1.000	0.750	0.000
0.500	1.000	1.000	1.000	1.000	1.000	1.000	1.000
0.500	0.000	0.500	0.000	0.500	0.000	0.000	0.000
0.250	0.750	0.750	0.750	0.500	0.250	0.250	0.250
1.000	0.750	0.750	0.500	0.000	0.750	0.750	0.750
0.000	0.250	1.000	1.000	0.750	0.000	0.250	0.000
1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1.000	0.500	0.750	0.500	0.500	0.750	0.750	1.000
0.750	0.750	1.000	0.750	0.000	0.750	0.750	0.750
0.625	0.528	0.566	0.659	0.456	0.549	0.493	0.494

Small Purple	Small Red	Small Orange	Medium Yellow	Medium White	Medium Blue	Medium Purple	Medium Red
0.720	0.595	0.625	0.565	0.655	0.455	0.545	0.490
0.720	0.595	0.625	0.565	0.655	0.455	0.545	0.490

0.720	0.595	0.625	0.565	0.655	0.455	0.545	0.490
0%	0%	0%	0%	0%	0%	0%	0%
0%	0%	0%	0%	0%	0%	0%	0%

Large Green	Large Yellow	Large White	Large Blue	Large Purple	Large Red	Large Orange	Model Weights
0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.065
0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.046
0.500	0.000	0.750	0.500	0.250	0.250	0.500	0.014
0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.045
0.750	0.750	0.500	0.500	0.750	0.500	0.750	0.033
0.750	0.000	0.250	0.250	0.750	0.750	0.750	0.020
0.500	0.000	0.000	0.000	0.000	0.000	0.000	0.028
0.750	0.250	0.750	0.000	0.250	0.000	0.500	0.030
0.750	1.000	1.000	1.000	0.250	0.250	0.250	0.029
0.500	0.500	0.750	0.750	0.500	0.500	0.500	0.067
0.750	0.000	0.750	0.750	0.250	0.250	0.500	0.044
0.750	0.250	0.750	0.000	0.250	0.000	0.750	0.039
0.750	0.750	1.000	0.750	0.750	1.000	1.000	0.031
0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.032
0.250	0.250	0.250	0.500	0.750	0.750	0.750	0.012
0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.029
1.000	0.000	0.500	0.000	0.000	0.000	0.250	0.060
0.000	0.750	0.500	0.250	1.000	0.750	0.000	0.123
0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.023
0.500	1.000	0.500	1.000	0.500	0.000	0.500	0.039
0.750	0.750	0.750	0.500	0.250	0.250	0.250	0.042
0.500	0.500	0.250	0.000	0.500	0.500	0.500	0.024
0.250	1.000	1.000	0.750	0.000	0.250	0.000	0.029
0.750	0.750	0.750	0.750	0.750	0.750	0.750	0.023
0.000	0.000	0.000	0.000	0.250	0.250	0.000	0.053
0.500	0.500	0.500	0.000	0.500	0.500	0.750	0.018
0.536	0.513	0.586	0.452	0.501	0.440	0.434	
Medium Orange	Large Yellow	Large White	Large Blue	Large Purple	Large Red	Large Orange	
0.490	0.510	0.585	0.450	0.500	0.440	0.430	
0.490	0.510	0.585	0.450	0.500	0.440	0.430	

0.490	0.510	0.585	0.450	0.500	0.440	0.430	
0%	0%	0%	0%	0%	0%	0%	
0%	0%	0%	0%	0%	0%	0%	



4000' 2000' 0 4000'

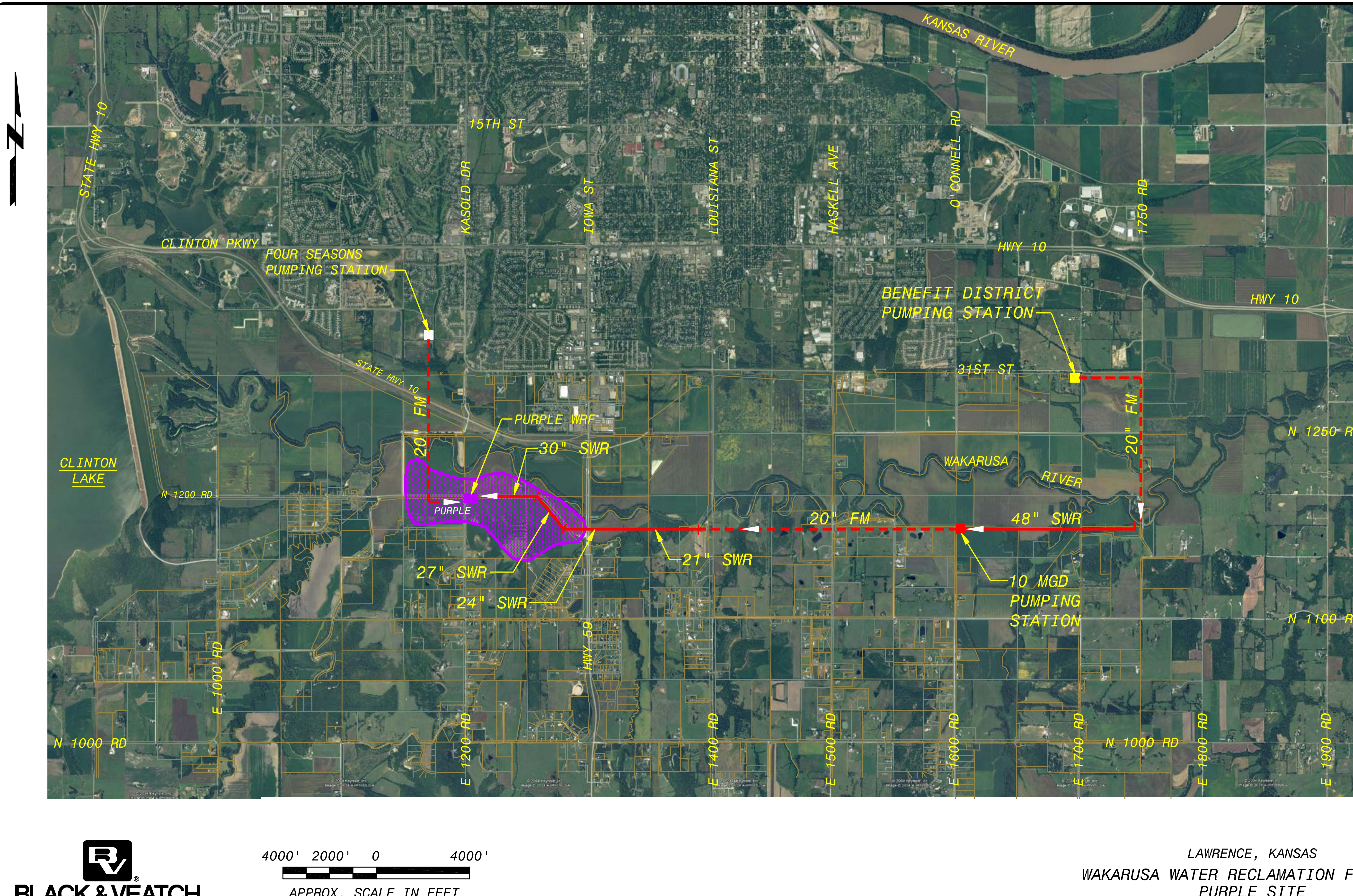
APPROX. SCALE IN FEET

BLACK & VEATCH
Corporation
Kansas City, Missouri

LAWRENCE, KANSAS

WAKARUSA WATER RECLAMATION FACILITY
RED SITE

BLACK & VEATCH
2006

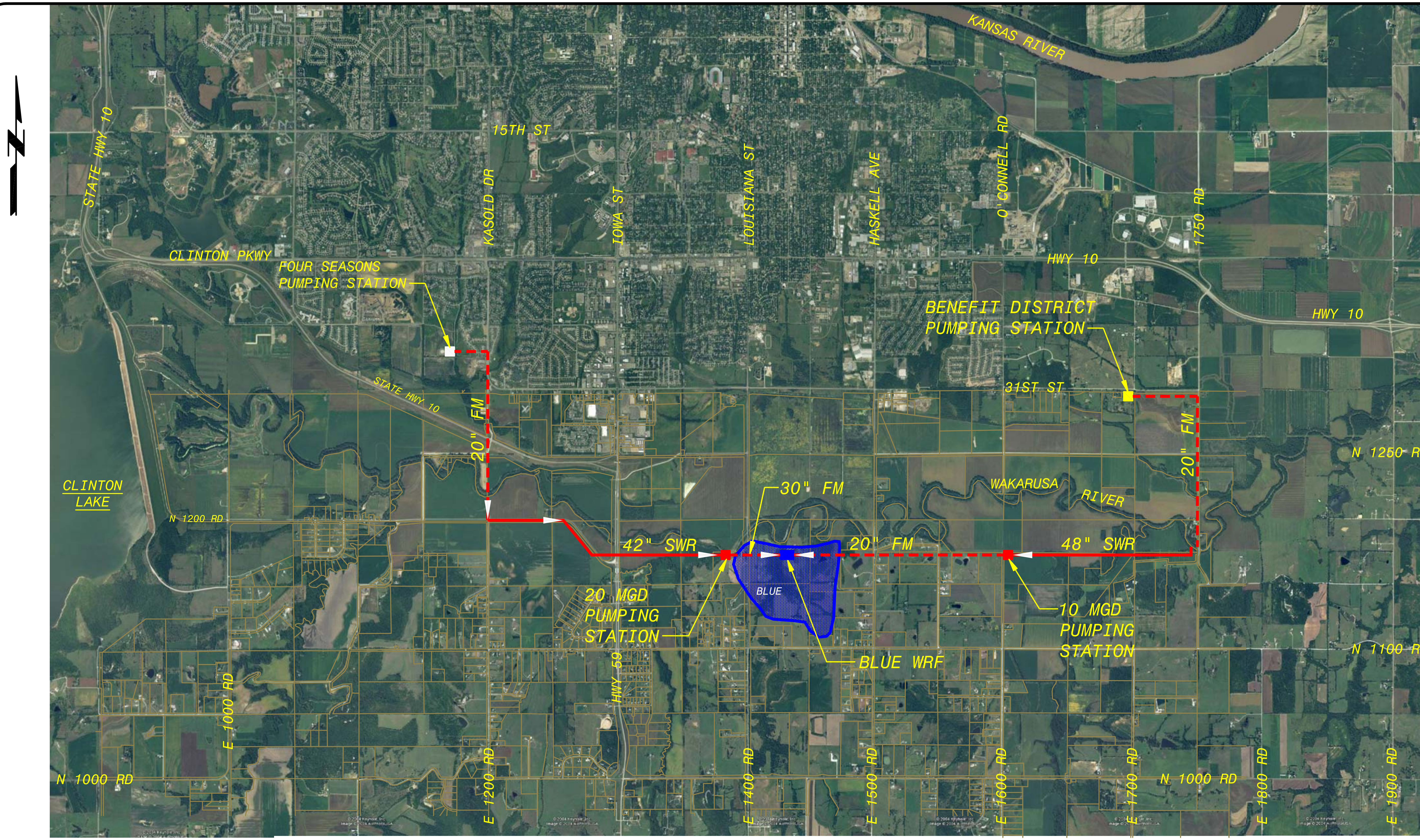


BLACK & VEATCH Corporation
Kansas City, Missouri

LAWRENCE, KANSAS

WAKARUSA WATER RECLAMATION FACILITY
PURPLE SITE

BLACK & VEATCH
2006



BLACK & VEATCH
Corporation
Kansas City, Missouri

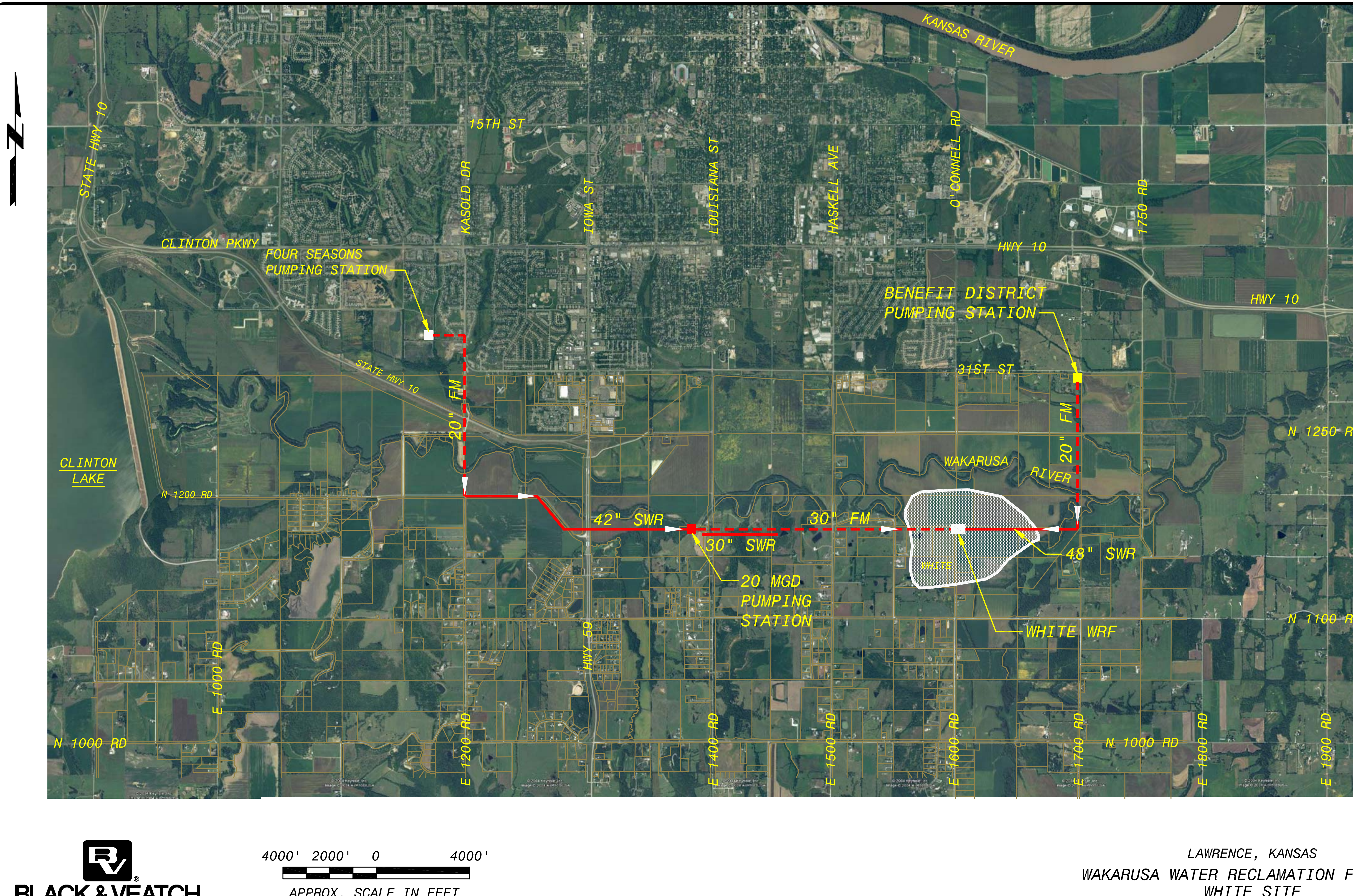
4000' 2000' 0 4000'

APPROX. SCALE IN FEET

LAWRENCE, KANSAS

WAKARUSA WATER RECLAMATION FACILITY
BLUE SITE

BLACK & VEATCH
2006

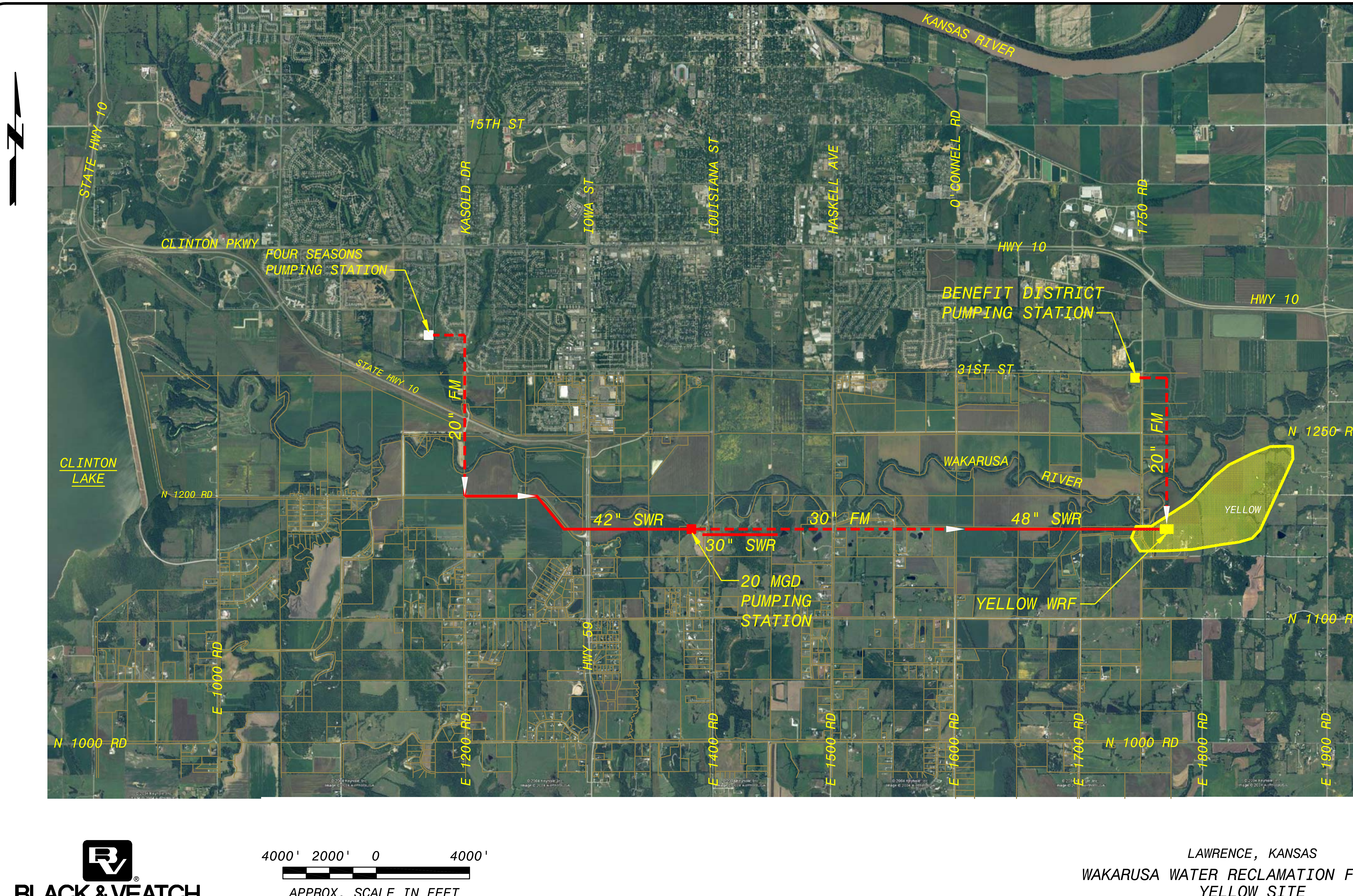


BLACK & VEATCH
Corporation
Kansas City, Missouri

LAWRENCE, KANSAS

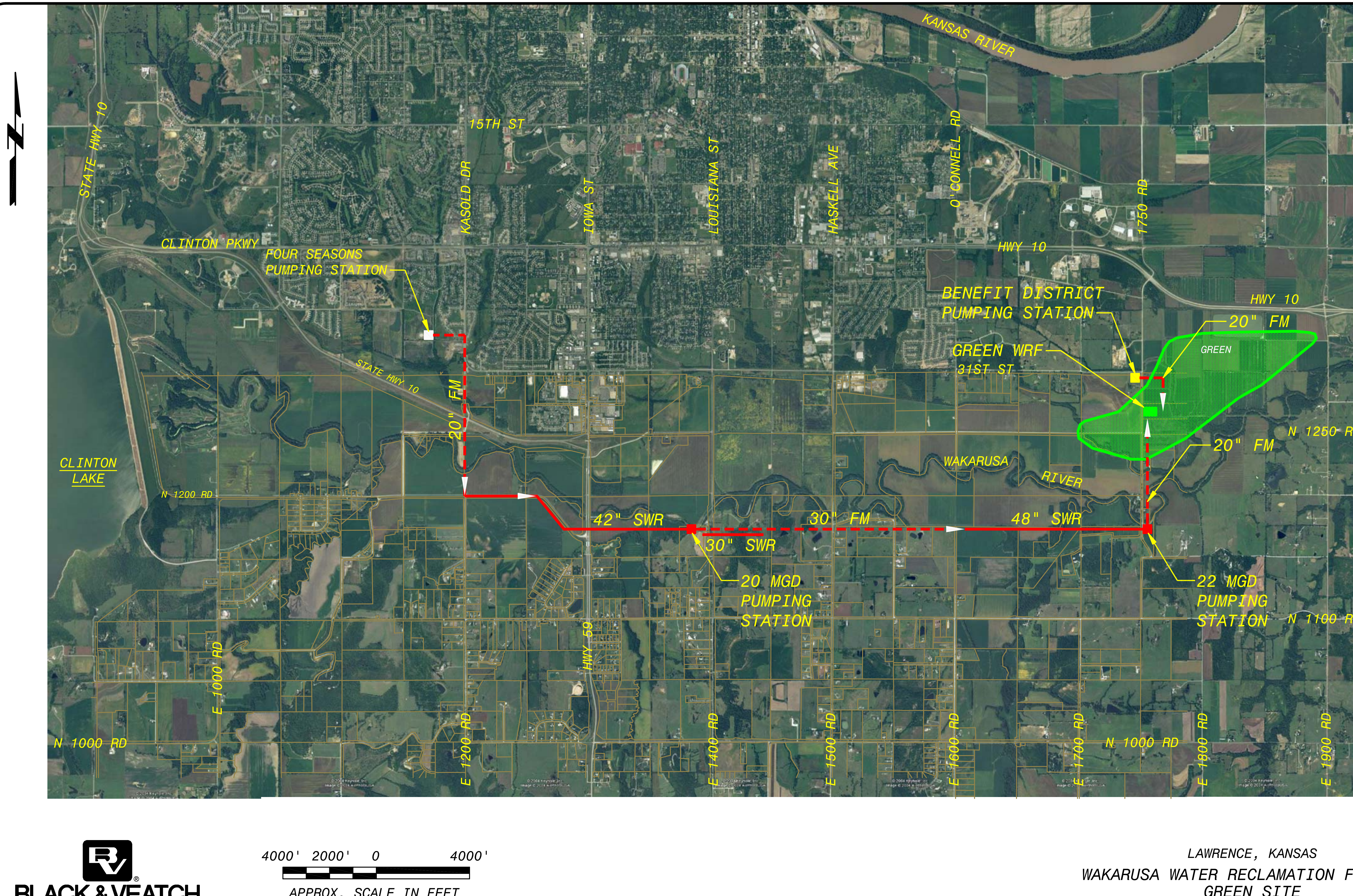
WAKARUSA WATER RECLAMATION FACILITY
WHITE SITE

BLACK & VEATCH
2006



BLACK & VEATCH
Corporation
Kansas City, Missouri

LAWRENCE, KANSAS
WAKARUSA WATER RECLAMATION FACILITY
YELLOW SITE
BLACK & VEATCH
2006



BLACK & VEATCH Corporation
Kansas City, Missouri

LAWRENCE, KANSAS

WAKARUSA WATER RECLAMATION FACILITY
GREEN SITE

BLACK & VEATCH
2006

Summary of Potential Wakarusa WRF Amenities

				Amenity Characteristics						
Potential Site Amenities	Description	Additional* Capital Cost ($)	Additional* Annual O&M Costs ($)	Preservation of open space	Maintains existing landuse	Encourages public use	Provides educational benefits	Promotes energy conservation	Specialized staff not required	Comments
Green Space	Facility buffer area is maintained free of structures and in its natural state; may be leased to farmers for agricultural purposes if use continues to fit adjacent land use	None. Buffer space is required as part of WRF design	None. Buffer space is required as part of WRF design	✓✓✓	✓✓✓				✓✓✓	
Bike/Hike Trails	Trail located on WRF buffer lands; could provide trailhead location for Lawrence Trail System	$500,000 to $1,500,000 $50 to 100/ ft of trail Varies based upon extent of trail	$10,000 to $25,000 Varies based upon extent of trail	✓✓		✓✓✓	✓		✓✓✓	May require additional odor control – costing an additional $500,000 to $1,000,000

* Indicates costs beyond those already estimated as part of the Wakarusa WRF.

7/11/2006

✓✓✓ = Highest rating with regard to characteristic

✓✓= Medium rating with regard to characteristic

✓ = Low rating with regard to characteristic

No check = amenity does not meet the characteristic at all

Summary of Potential Wakarusa WRF Amenities

				Amenity Characteristics						
Potential Site Amenities	Description	Additional* Capital Cost ($)	Additional* Annual O&M Costs ($)	Preservation of open space	Maintains existing landuse	Encourages public use	Provides educational benefits	Promotes energy conservation	Specialized staff not required	Comments
Constructed Wetlands	Outdoor wetland polishing facility located on buffer land; likely to include walkways for public use	$5,000,000	$100,000	✓✓✓		✓✓✓	✓✓		✓	May require additional odor control – costing an additional $500,000 to $1,000,000
Demonstration Area/Educational Opportunities	Facilities for public and/or academic education focusing on the wastewater treatment process; could also provide community meeting space and other community needs	Varies significantly depending on facilities desired	Varies significantly depending on facilities desired	✓		✓✓✓	✓✓✓		Depends on facilities constructed	May require additional odor control – costing an additional $500,000 to $1,000,000

* Indicates costs beyond those already estimated as part of the Wakarusa WRF.

7/11/2006

✓✓✓ = Highest rating with regard to characteristic

✓✓= Medium rating with regard to characteristic

✓ = Low rating with regard to characteristic

No check = amenity does not meet the characteristic at all

Summary of Potential Wakarusa WRF Amenities

				Amenity Characteristics						
Potential Site Amenities	Description	Additional* Capital Cost ($)	Additional* Annual O&M Costs ($)	Preservation of open space	Maintains existing landuse	Encourages public use	Provides educational benefits	Promotes energy conservation	Specialized staff not required	Comments
LEED Design for Administration Building	The LEED (Leadership in Energy and Environmental Design) Green Building Rating System® is a voluntary, consensus-based national standard for developing high-performance, sustainable buildings.	Varies significantly based on whether or not building is to be LEED certified and level of LEED construction desired	Varies based on building features. Should be reduced from buildings constructed using conventional materials	✓✓✓	✓✓✓		✓✓	✓✓	✓✓✓	May require additional odor control – costing an additional $500,000 to $1,000,000

* Indicates costs beyond those already estimated as part of the Wakarusa WRF.

7/11/2006

✓✓✓ = Highest rating with regard to characteristic

✓✓= Medium rating with regard to characteristic

✓ = Low rating with regard to characteristic

No check = amenity does not meet the characteristic at all

Summary of Potential Wakarusa WRF Amenities

				Amenity Characteristics						
Potential Site Amenities	Description	Additional* Capital Cost ($)	Additional* Annual O&M Costs ($)	Preservation of open space	Maintains existing landuse	Encourages public use	Provides educational benefits	Promotes energy conservation	Specialized staff not required	Comments
Microbial Fuel Cells	Converts digester gas to electric power through electrochemical reaction.	$5,000 to $7,000 per kW installed	$100,000 every 5 years for stack replacement	✓✓✓	✓✓✓	✓	✓	✓✓✓	✓✓	BDR to study location of solids handling – may not be included in initial construction phase at Wakarusa WRF

* Indicates costs beyond those already estimated as part of the Wakarusa WRF.

7/11/2006

✓✓✓ = Highest rating with regard to characteristic

✓✓= Medium rating with regard to characteristic

✓ = Low rating with regard to characteristic

No check = amenity does not meet the characteristic at all

Summary of Potential Wakarusa WRF Amenities

				Amenity Characteristics						
Potential Site Amenities	Description	Additional* Capital Cost ($)	Additional* Annual O&M Costs ($)	Preservation of open space	Maintains existing landuse	Encourages public use	Provides educational benefits	Promotes energy conservation	Specialized staff not required	Comments
Microturbines	Provides electrical generation capacity for use in plant or for sale	$1,500 to $3,000/kW installed	Save $0.11/kW installed	✓✓✓	✓✓✓	✓	✓	✓✓✓	✓✓	BDR to study location of solids handling – may not be included in initial construction phase at Wakarusa WRF

* Indicates costs beyond those already estimated as part of the Wakarusa WRF.

7/11/2006

✓✓✓ = Highest rating with regard to characteristic

✓✓= Medium rating with regard to characteristic

✓ = Low rating with regard to characteristic

No check = amenity does not meet the characteristic at all

Summary of Potential Wakarusa WRF Amenities

				Amenity Characteristics						
Potential Site Amenities	Description	Additional* Capital Cost ($)	Additional* Annual O&M Costs ($)	Preservation of open space	Maintains existing landuse	Encourages public use	Provides educational benefits	Promotes energy conservation	Specialized staff not required	Comments
Reuse Methane	Biogas from digester is used as fuel for small modular combustion turbines to heat digesters and provide building temperature control	$2,000,000 to $3,000,000	TBD	✓✓✓	✓✓✓	✓	✓	✓✓✓	✓✓✓	BDR to study location of solids handling – may not be included in initial construction phase at Wakarusa WRF
Heat Pumps for Plant Effluent	Utilizes plant effluent to evaporate refrigerant, heating water to be used to heat plant buildings	$110,000/ facility mgd	Save $0.07/ facility mgd	✓✓✓	✓✓✓	✓	✓	✓✓✓	✓✓✓	

* Indicates costs beyond those already estimated as part of the Wakarusa WRF.

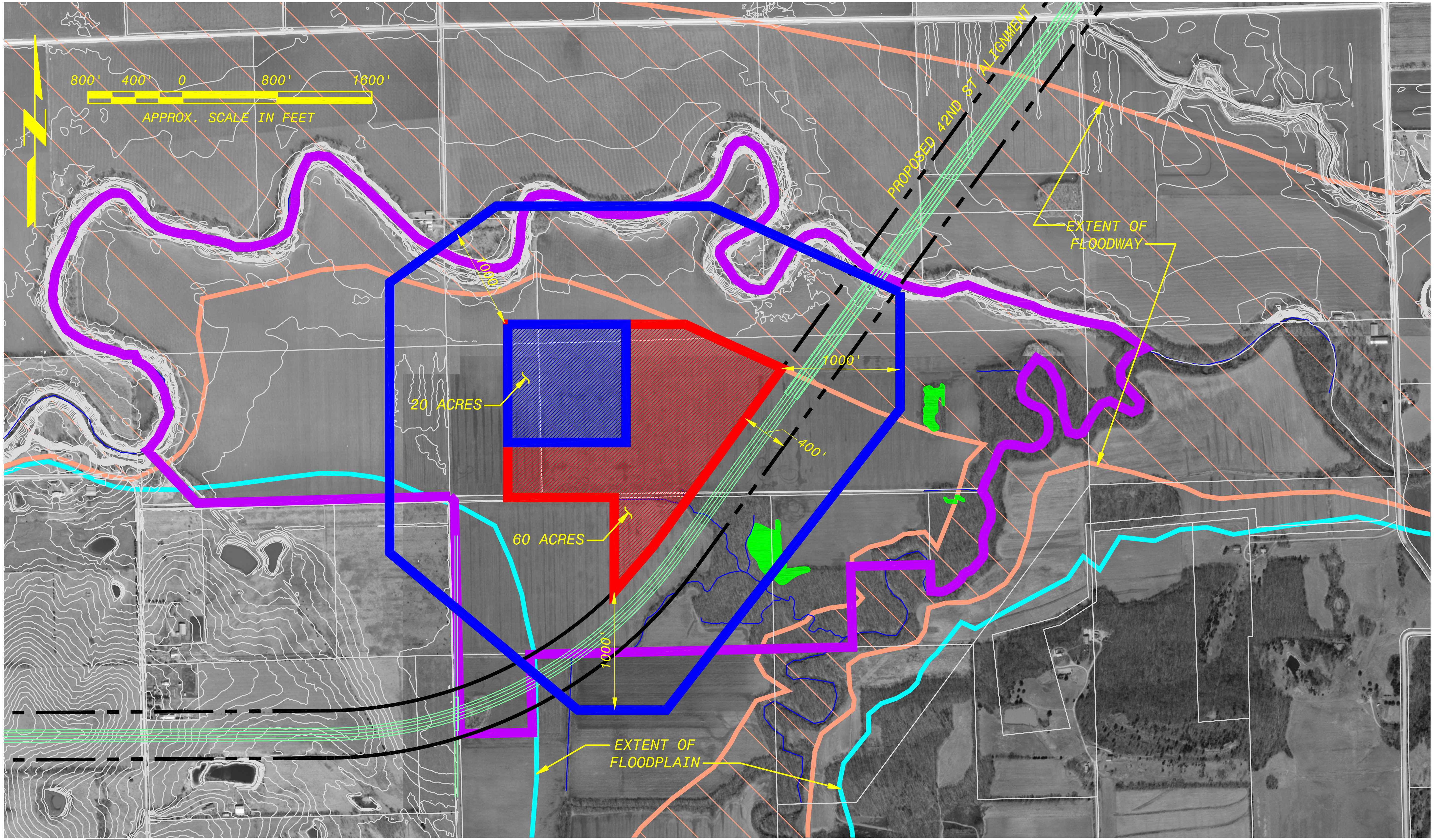
7/11/2006

✓✓✓ = Highest rating with regard to characteristic

✓✓= Medium rating with regard to characteristic

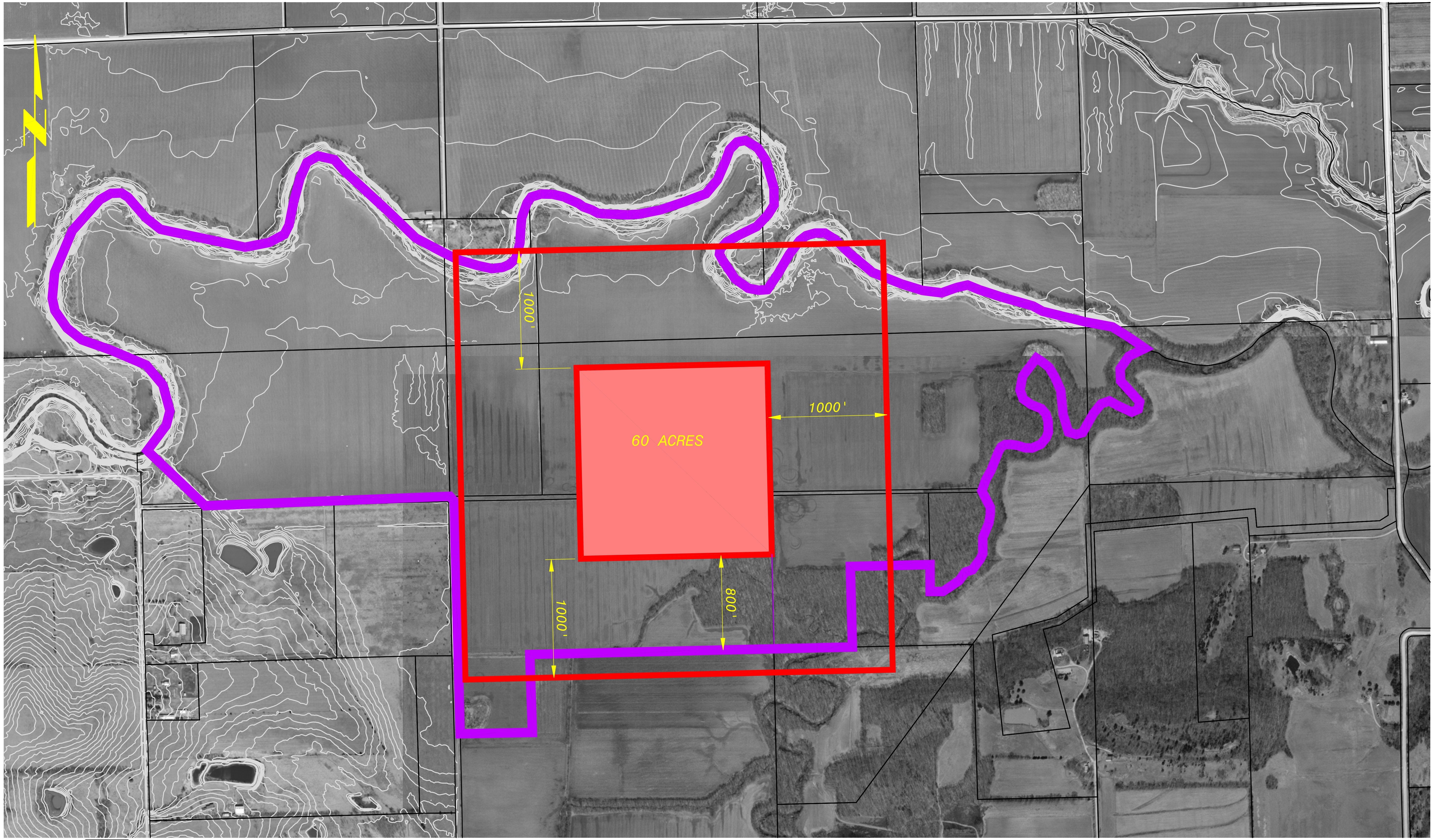
✓ = Low rating with regard to characteristic

No check = amenity does not meet the characteristic at all



BLACK & VEATCH Corporation
Kansas City, Missouri

LAWRENCE, KANSAS
WAKARUSA WATER RECLAMATION FACILITY
PRELIMINARY 7 MGD FACILITY LAYOUT
WHITE SITE
BLACK & VEATCH
2006



800' 400' 0 800' 1600'

APPROX. SCALE IN FEET

LEGEND:

FACILITY SITE

FACILITY BUFFER

LAND REQUIRED TO PURCHASE FULL PARCELS

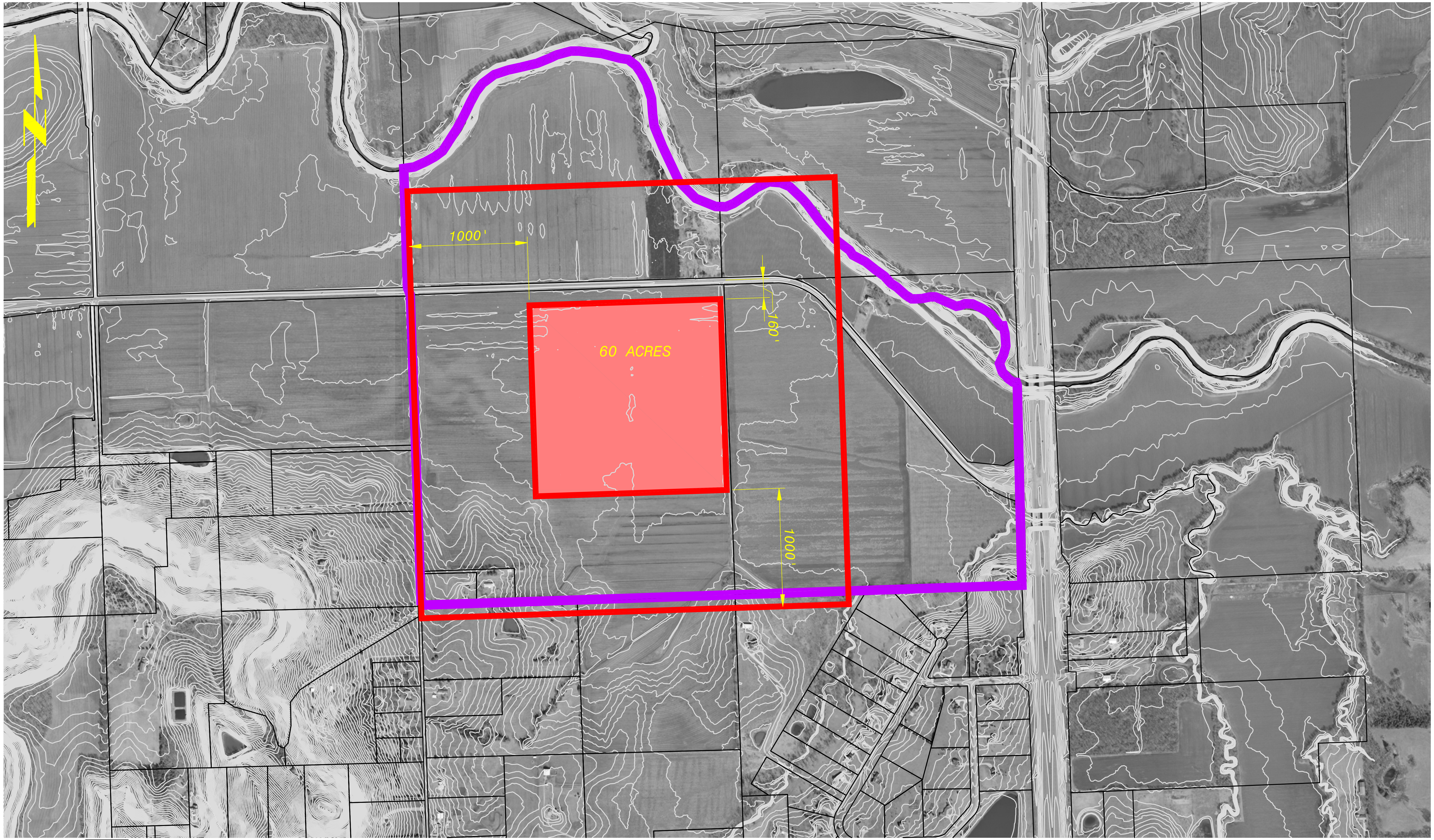
ELEVATION CONTOURS

BLACK & VEATCH Corporation
Kansas City, Missouri

LAWRENCE, KANSAS

WAKARUSA WATER RECLAMATION FACILITY
WHITE SITE

BLACK & VEATCH
2006



LEGEND:

- FACILITY SITE
- FACILITY BUFFER
- LAND REQUIRED TO PURCHASE FULL PARCELS
- ELEVATION CONTOURS

BLACK & VEATCH Corporation
Kansas City, Missouri

LAWRENCE, KANSAS

WAKARUSA WATER RECLAMATION FACILITY
PURPLE SITE

BLACK & VEATCH
2006

Date	**To**
03/16/2006	John Pasley, HNTB Project Manager

Interoffice Correspondence

From

Amy Owens, HNTB Hydraulics

Subject

Summary of Hydraulic Analysis for the Location Study of the Proposed Wakarusa Water Reclamation Facility (WRF) in South Lawrence, Kansas

Job Number: 41084

<u>Existing Conditions</u>

The seven proposed Wakarusa Water Reclamation Facility (WRF) sites in South Lawrence, Kansas sites are located adjacent to or in the floodplain of the Wakarusa River, which is a FEMA regulated stream. A split floodway is designated along the Wakarusa River. The northern split (left bank) Wakarusa floodway is located between the Wakarusa River and 31st Street, somewhat paralleling the proposed South Lawrence Trafficway alignment from just west of Louisiana Street, downstream to East 1700 Road. A separate hydraulic model for the split-flow path along the northern (left) overbank of the Wakarusa River as well as the main channel model was created by FEMA. The analyses performed by HNTB for this project include modifications to the main channel 100-year floodplain model. Because these proposed project sites will not directly impact the split flow model, the split flow model was not modified.

HNTB requested the hydraulic model and accompanying data from FEMA in November 2005. Unfortunately FEMA was not able to find their latest existing conditions HEC-2 model which was last updated by Michael Baker in 1996. However, HNTB had an older version of the FEMA model, so the model did not have to be created from scratch. This older HEC-2 model was first converted to HEC-RAS and then calibrated to match the results of the official FEMA Flood Insurance Study (FIS) dated November 7, 2001. The existing conditions model was calibrated by adjusting the roughness coefficients, encroachments and floodway widths. The existing conditions model was calibrated until the water surface elevations were within 0.1 foot of the FIS report in the vicinity of the proposed WRF sites. The existing condition discharges utilized were the same as those used in the latest FEMA FIS. The following Table 1 summarizes the results of the calibration.

TABLE 1: EXISTING CONDITIONS WAKARUSA RIVER MAIN CHANNEL CALIBRATED MODEL					
Cross Section		Floodway Water Surface		Floodplain Water Surface	
		Elev. (feet NAVD)		Elev. (feet NAVD)	
Name	Number	FEMA[1]	Calibrated Model[2]	FEMA[1]	Calibrated Model[2]
D	12340	808.2	808.3	807.6	807.6
E	14400	809.6	809.6	809.1	809.1
F	18689	811.2	811.2	810.8	810.8
G	19265	811.5	811.5	811.1	811.1
H	26873	812.3	812.3	811.9	811.9
I	27425	812.5	812.5	812.1	812.1
J	33615	813.4	813.4	813.0	813.0
K	42199	814.5	814.5	813.9	813.9
L	42470	815.0	815.0	814.5	814.5
M	44790	816.0	816.0	815.6	815.6
N	52590	819.3	819.3	818.8	818.8
O	66919	825.2	825.2	824.6	824.6
P	66947	825.3	825.3	824.7	824.7
Q	72525	827.2	827.2	826.7	826.7
R	76030	828.4	828.4	827.8	827.8
S	77365	828.5	828.5	827.9	827.9
T	79600	829.1	829.1	828.6	828.6
U	83149	829.6	829.6	829.1	829.1
V	83281	829.6	829.6	829.1	829.1
W	87085	830.7	830.7	829.7	829.7
X	90490	831.6	831.6	830.6	830.6
Y	94949	832.9	832.9	832.2	832.2
Z	94981	832.9	832.9	832.2	832.2
AA	98210	833.3	833.3	832.7	832.7
AB	106345	833.3	833.3	832.7	832.7

Notes:

1 Information from November 7, 2001 Official FEMA FIS Floodway Data Table

2 Old version of HEC-2 model converted to HEC-RAS and calibrated to the official FEMA FIS

Wet Weather Flow

The hydraulic analyses were performed using the US Army Corps of Engineers' computer program HEC-RAS Version 3.1.2 to determine the impacts of the proposed project. A hydraulic analysis of two different wet weather flows at two different locations was performed. The two wet weather flows modeled include 42 MGD (65 cfs) and 300 MGD (465 cfs) and represent the peak wet weather discharges with a 6:1 peaking factor. These flows were added to the existing FEMA FIS 100-year flows. They were modeled at the two most probable WRF proposed locations which include the Purple' site located south of the Wakarusa River and west of Highway 59 and the 'White' site located south of Wakarusa River along E 1600 Road north of N 1100 Road. It was assumed that all of the additional flow stays within the main channel; therefore the split flow relationship was not recalculated. The following Table 2 summarizes the results.

TABLE 2: SUMMARY OF HYDRAULIC RESULTS DUE TO INCREASED WET WEATHER FLOWS										
Cross Section		Exist. Cond.	Proposed Conditions							
			Increased Flows at 'Purple' WRF Site				Increased Flows at 'White' WRF Site			
			Additonal 300 MGD (465 cfs)		Additonal 42 MGD (65 cfs)		Additonal 300 MGD (465 cfs)		Additonal 42 MGD (65 cfs)	
Name	Number		Water Surface Elev. (ft)	Diff. (ft)	Water Surface Elev. (ft)	Diff. (ft)	Water Surface Elev. (ft)	Diff. (ft)	Water Surface Elev. (ft)	Diff. (ft)
D	12340	807.63	807.77	0.14	807.65	0.02	807.77	0.14	807.65	0.02
E	14400	809.13	809.31	0.18	809.16	0.03	809.31	0.18	809.16	0.03
F	18689	810.77	810.95	0.18	810.8	0.03	810.95	0.18	810.8	0.03
G	19265	811.09	811.28	0.19	811.11	0.02	811.28	0.19	811.11	0.02
H	26873	811.92	812.1	0.18	811.95	0.03	812.1	0.18	811.95	0.03
I	27425	812.15	812.32	0.17	812.17	0.02	812.32	0.17	812.17	0.02
J	33615	812.97	813.12	0.15	812.99	0.02	813.12	0.15	812.99	0.02
K	42199	813.92	814.05	0.13	813.94	0.02	814.05	0.13	813.94	0.02
L	42470	814.46	814.62	0.16	814.48	0.02	814.62	0.16	814.48	0.02
M	44790	815.62	815.81	0.19	815.64	0.02	815.81	0.19	815.64	0.02
N	52590	818.78	819.1	0.32	818.82	0.04	819.1	0.32	818.82	0.04
O	66919	824.62	824.81	0.19	824.65	0.03	824.7	0.08	824.63	0.01
P	66947	824.7	824.89	0.19	824.73	0.03	824.78	0.08	824.71	0.01
Q	72525	826.74	826.94	0.20	826.77	0.03	826.78	0.04	826.75	0.01
R	76030	827.84	828.05	0.21	827.87	0.03	827.86	0.02	827.84	0.00
S	77365	827.93	828.15	0.22	827.96	0.03	827.96	0.03	827.93	0.00
T	79600	828.64	828.9	0.26	828.67	0.03	828.66	0.02	828.64	0.00
U	83149	829.12	829.4	0.28	829.16	0.04	829.15	0.03	829.13	0.01
V	83281	829.12	829.4	0.28	829.16	0.04	829.14	0.02	829.12	0.00
W	87085	829.69	829.95	0.26	829.73	0.04	829.71	0.02	829.7	0.01
X	90490	830.59	830.76	0.17	830.62	0.03	830.6	0.01	830.59	0.00
Y	94949	832.21	832.36	0.15	832.23	0.02	832.22	0.01	832.21	0.00
Z	94981	832.24	832.38	0.14	832.26	0.02	832.24	0.00	832.24	0.00
AA	98210	832.66	832.81	0.15	832.68	0.02	832.66	0.00	832.66	0.00
AB	106345	832.71	832.86	0.15	832.74	0.03	832.72	0.01	832.72	0.01

As shown in Table 2, the greatest increase in water surface elevation is 0.32 feet which occurs at Cross-Section N which is located in the vicinity of the ‘White’ site. This 0.32 foot increase occurs when the 300 MGD (465 cfs) is added to the 100-year flow at either the ‘Purple’ or ‘White’ site.

The effects of these increased flows fall within the limits of the FEMA criteria. Per the *2003 FEMA Guidelines and Specifications for Flood Hazard Mapping Partners*, "If the new flood discharges yield Base Flood Elevations (BFEs) that differ from the effective BFEs obtained from the effective water-surface profile by more than 0.5 foot, or if, in flat areas, the floodplain boundaries will be significantly changed, a detailed hydrologic analysis shall be conducted. Otherwise, the Mapping Partner shall not perform a revised hydrologic analysis for the selected stream at this time, unless other substantial changes in hydraulic conditions exist, such as channelization and construction of flood-control structures, or unless there are errors in the effective study." Therefore, a FEMA map revision should not be necessary due to the increased proposed plant wet weather flows as the increase in BFE is only 0.32 feet.

If it is decided to mitigate the effects of the increased water surface elevation, there are options available. For example, the conveyance capacity of the channel could be increased by utilizing channel improvements to provide additional flow area which would lower the water surface elevation. This could include widening or deepening the channel or utilizing flood benches which could be designed to maintain the low flow configuration and the natural meandering characteristics of the stream.

Dry Weather Flow

The information from the USGS gage at Hwy 59 was utilized to calculate that the average daily flow since 1981 (when Clinton Lake's multipurpose pool was established) is 274 cfs. The proposed maximum dry weather daily flow of 50 MGD (77cfs) would add approximately 25 percent more flow to the dry weather flow. Hydraulically this is not a problem as there is sufficient capacity within the channel during low flow periods.

Estimate of Proposed Level of Protection at the Proposed Wakarusa WRF Sites

The following Table 3 summarizes the estimate of proposed level of protection at the seven different WRP proposed locations. The elevations shown in this table are conservative in that they are located at the most upstream portion of the footprint of the different proposed sites. Based on the 2001 FEMA FIS, the existing WRF is at just about a 500-year level of protection. The 500-year water surface elevation is 829 feet, the 100-year water surface elevation is 821 feet and the existing plant's level of protection is 828 feet.

TABLE 3: ESTIMATE OF PROPOSED LEVEL OF PROTECTION AT THE PROPOSED WAKARUSA WRF SITES

Proposed WRF Sites	Most Upstream FEMA X-Section	100-year W.S.E.	Approx. 500-year W.S.E.*	Approx. Proposed Level of Protection based on the Existing WRF's level of protection.
ORANGE	AB	832.7	836.9	836.4
RED	Between AA/AB	832.7	836.6	836.1
PURPLE	Y	832.2	835.2	834.8
BLUE	S	827.9	829	828.9
WHITE	Between N/O	821.7	823.7	823.5
GREEN	M	815.6	818.6	818.2
YELLOW	K	813.9	818.3	817.8

* Only the 100-year profile is shown on the latest 2001 FIS. The 1980 FIS has all 4 profiles. Therefore the 500-year w.s.e. was estimated by using the 100-year 2001 FIS elevations and adding the difference between the 1980 100-year and 500-year profiles.

Possible Future Hydraulic Analyses

Once the preferred WRF site has been selected and the proposed grading and layout information is available an additional hydraulic evaluation will be necessary if any of the WRF sites are located within an existing floodplain. This analysis will be conducted to determine potential impacts to the floodplains. Per FEMA regulations, if the proposed improvements result in more than a 1.0 foot increase in the floodplain water surface elevation then a restudy and map revision will be necessary.

Date

04/13/2006

Updated 4/25/2006

To

John Pasley, HNTB Project Manager

HNTB

From

Amy Owens, HNTB Hydraulics

Interoffice Correspondence

Subject

Summary of Hydrologic/Hydraulic Analysis for the Location Study of the Proposed Wakarusa Water Reclamation Facility (WRF) in South Lawrence, Kansas – Sensitivity Analysis of a Range of Flows Approximating Fully Developed Conditions

Job Number: 41084

General

The proposed Wakarusa Water Reclamation Facility (WRF) sites in South Lawrence, Kansas sites are located adjacent to or in the floodplain of the Wakarusa River, which is a FEMA regulated stream. The hydraulic analyses performed by HNTB for this project include modifications to the main channel 100-year floodplain model. Because these proposed project sites will not directly impact the split flow model, the split flow model was not modified. The hydraulic analyses were performed using the US Army Corps of Engineers' computer program HEC-RAS Version 3.1.2 to determine the impacts of the proposed project. Refer to the memo dated 3/16/2006 for more information on the hydraulic analyses which have been completed to date.

The purpose of this report is to summarize the sensitivity analysis which was performed to determine how much the water surface elevations change with a range of potential fully developed flows. The range of increased flows was chosen to approximate fully developed flows. This will help give a sense for how much the hydraulics may be affected by fully developed conditions. This analysis is intended to be used as a tool to estimate at what elevation the future WRF may need to be located based on fully developed flows. This analysis is not intended to model the differential impact of the additional wet weather flow contributed by the proposed WRF. Instead, this study provides an analysis of the "worst-case scenario," contrasting the impact of full development of the area with existing FEMA water surface elevations with the wet weather flow of the proposed WRF factored into all analyses.

Summary of the City of Lawrence's Floodplain Management Ordinance

According to the City of Lawrence's Floodplain Management Ordinance, a Hydrologic and Hydraulic Study needs to be completed assuming full development of the watershed in all calculations based on the current comprehensive land use plan or other reasonable assumptions of impervious cover. (Ordinance 20-9A04(c)(v))

Per this ordinance, a new Base Flood Elevation should be developed based on full development which will serve as the base line comparison. This is assuming the new Base Flood Elevation established by the analysis is higher than the current FEMA FIS Floodplain. The higher of the two controls: either the new Base Flood Elevation, or the FEMA FIS Floodplain. (Ordinance 20-9A03(d)(1)(ii)a). Then any construction that occurs within the new Base Flood Elevation is not allowed to increase the Base Flood Elevation or the velocity by any amount (Ordinance 20-9A01(f)(5))

Fully Developed Conditions Sensitivity Analysis

At a meeting held with Black and Veatch and HNTB on March 21st, 2006 it was decided to conduct a sensitivity analysis of fully developed flows on the water surface elevations. This analysis will help estimate at what elevation the future WRF may need to be located based on potential fully developed flows. Fully developed conditions were approximated by increasing the existing condition flows by differing percentages. The FEMA FIS 100-year existing condition flows plus the proposed WRF wet weather flow of 300 MGD (465 cfs) were used as the baseline flows. These flows were then increased by 10, 20, 30, 40, and 50 percent to approximate a range of possible fully developed flows. This range of flows was modeled at the two most probable WRF proposed locations which include the Purple Site located south of the Wakarusa River and west of Highway 59 and the White Site located south of Wakarusa River along E 1600 Road north of N 1100 Road. The White Site is located between FEMA Cross-Section O and N, just downstream of Haskell Avenue. The Purple Site is located between FEMA Cross-Section Y and V, between E1150 Road and Iowa Street. It was assumed that all of the additional flow stays within the main channel; therefore the split flow relationship was not recalculated.

The following table is a summary of results based on the increased wet weather flow of 300 MGD occurring at the White WRF site.

SUMMARY OF HYDRAULIC RESULTS FOR WHITE WRF SITE WET WEATHER FLOWS -- ESTIMATING DIFFERENT LEVELS OF FULLY DEVELOPED CONDITIONS

Cross-Section			Proposed Conditions Water Surface Elevations											
			Existing Conditions Plus Wet Weather Flows from White WRF Site		Estimation of Fully Developed Conditions (The differences shown are versus the current FEMA elevations from the 3rd column)									
FEMA X-Sect Name	FEMA X-Sect #	FEMA Exist. Cond. Water Surface Elev.			10% Increase		20% Increase		30% Increase		40% Increase		50% Increase	
			RUNB1		RUN_White10		RUN_White20		RUN_White30		RUN_White40		RUN_White50	
			Water Surf. Elev. (ft)	Diff. (ft)	Water Surf. Elev. (ft)	Diff. (ft)	Water Surf. Elev. (ft)	Diff. (ft)	Water Surf. Elev. (ft)	Diff. (ft)	Water Surf. Elev. (ft)	Diff. (ft)	Water Surf. Elev. (ft)	Diff. (ft)
D	12340	807.63	807.77	0.14	808.32	0.69	808.87	1.24	809.42	1.79	809.97	2.34	810.52	2.89
E	14400	809.13	809.31	0.18	809.98	0.85	810.64	1.51	811.29	2.16	811.92	2.79	812.53	3.40
F	18689	810.77	810.95	0.18	811.63	0.86	812.27	1.50	812.85	2.08	813.4	2.63	813.92	3.15
G	19265	811.09	811.28	0.19	811.99	**0.90**	812.66	1.57	813.28	2.19	813.87	2.78	814.42	3.33
H	26873	811.92	812.1	0.18	812.76	0.84	813.39	1.47	813.99	2.07	814.55	2.63	815.1	3.18
I	27425	812.15	812.32	0.17	812.98	0.83	813.6	1.45	814.18	2.03	814.74	2.59	815.27	3.12
J	33615	812.97	813.12	0.15	813.66	0.69	814.18	1.21	814.69	1.72	815.18	2.21	815.67	2.70
K	42199	813.92	814.05	0.13	814.47	0.55	814.88	0.96	815.27	1.35	815.65	1.73	816.03	2.11
L	42470	814.46	814.62	0.16	815.14	0.68	815.64	1.18	816.13	1.67	816.62	2.16	817.1	2.64
M	44790	815.62	815.81	0.19	816.22	0.60	816.69	1.07	817.15	1.53	817.59	1.97	818.03	2.41
N	52590	818.78	819.1	**0.32**	819.04	0.26	819.44	0.66	819.5	0.72	819.5	0.72	819.5	0.72
O	66919	824.62	824.7	0.08	825.19	0.57	826.57	1.95	826.98	2.36	827.46	2.84	827.91	3.29
P	66947	824.7	824.78	0.08	825.28	0.58	826.65	**1.95**	827.07	**2.37**	827.56	**2.86**	828.02	**3.32**
Q	72525	826.74	826.78	0.04	827.32	0.58	828.35	1.61	828.83	2.09	829.34	2.60	829.83	3.09
R	76030	827.84	827.86	0.02	828.45	0.61	829.4	1.56	829.91	2.07	830.45	2.61	830.96	3.12
S	77365	827.93	827.96	0.03	828.54	0.61	829.48	1.55	829.99	2.06	830.52	2.59	831.03	3.10
T	79600	828.64	828.66	0.02	829.31	0.67	830.27	1.63	830.65	2.01	831.21	2.57	831.75	3.11
U	83149	829.12	829.15	0.03	829.83	0.71	830.8	1.68	831.05	1.93	831.63	2.51	832.18	3.06
V	83281	829.12	829.14	0.02	829.83	0.71	830.79	1.67	831.05	1.93	831.62	2.50	832.17	3.05
W	87085	829.69	829.71	0.02	830.36	0.67	831.26	1.57	831.56	1.87	832.13	2.44	832.69	3.00
X	90490	830.59	830.6	0.01	831.04	0.45	831.69	1.10	831.97	1.38	832.46	1.87	832.96	2.37

Y	94949	832.21	832.22	0.01	832.59	0.38	833	0.79	833.27	1.06	833.61	1.40	833.96	1.75
Z	94981	832.24	832.24	0.00	832.61	0.37	833.03	0.79	833.29	1.05	833.63	1.39	833.98	1.74
AA	98210	832.66	832.66	0.00	833.03	0.37	833.43	0.77	833.7	1.04	834.03	1.37	834.36	1.70
AB	10634 5	832.71	832.72	0.01	833.09	0.38	833.49	0.78	833.77	1.06	834.09	1.38	834.42	1.71

The following table is a summary of results based on the increased wet weather flow of 300 MGD occurring at the Purple WRF site.

SUMMARY OF HYDRAULIC RESULTS FOR PURPLE WRF SITE WET WEATHER FLOWS -- ESTIMATING DIFFERENT LEVELS OF FULLY DEVELOPED CONDITIONS

Cross-Section		**FEMA Exist. Cond. Water Surface Elev.**	**Proposed Conditions Water Surface Elevations**											
			Existing Conditions Plus Wet Weather Flows from Purple WRF Site		**Estimation of Fully Developed Conditions (The differences shown are versus the current FEMA elevations from the 3rd column)**									
					10% Increase		**20% Increase**		**30% Increase**		**40% Increase**		**50% Increase**	
FEMA X-Sect Name	**FEMA X-Sect #**		**RUNC1**		**RUN_Purple10**		**RUN_Purple20**		**RUN_Purple30**		**RUN_Purple40**		**RUN_Purple50**	
			Water Surf. Elev. (ft)	Diff. (ft)	Water Surf. Elev. (ft)	Diff. (ft)	Water Surf. Elev. (ft)	Diff. (ft)	Water Surf. Elev. (ft)	Diff. (ft)	Water Surf. Elev. (ft)	Diff. (ft)	Water Surf. Elev. (ft)	Diff. (ft)
D	12340	807.63	807.77	0.14	808.32	0.69	808.87	1.24	809.42	1.79	809.97	2.34	810.52	2.89
E	14400	809.13	809.31	0.18	809.98	0.85	810.64	1.51	811.29	2.16	811.92	2.79	812.53	3.40
F	18689	810.77	810.95	0.18	811.63	0.86	812.27	1.50	812.85	2.08	813.40	2.63	813.92	3.15
G	19265	811.09	811.28	0.19	811.99	0.90	812.66	1.57	813.28	2.19	813.87	2.78	814.42	3.33
H	26873	811.92	812.10	0.18	812.76	0.84	813.39	1.47	813.99	2.07	814.55	2.63	815.10	3.18
I	27425	812.15	812.32	0.17	812.98	0.83	813.60	1.45	814.18	2.03	814.74	2.59	815.27	3.12
J	33615	812.97	813.12	0.15	813.66	0.69	814.18	1.21	814.69	1.72	815.18	2.21	815.67	2.70
K	42199	813.92	814.05	0.13	814.47	0.55	814.88	0.96	815.27	1.35	815.65	1.73	816.03	2.11
L	42470	814.46	814.62	0.16	815.14	0.68	815.64	1.18	816.13	1.67	816.62	2.16	817.10	2.64
M	44790	815.62	815.81	0.19	816.22	0.60	816.69	1.07	817.15	1.53	817.59	1.97	818.03	2.41
N	52590	818.78	819.10	**0.32**	819.04	0.26	819.44	0.66	819.50	0.72	819.50	0.72	819.50	0.72
O	66919	824.62	824.81	0.19	825.31	0.69	826.65	2.03	827.08	2.46	827.55	2.93	828.01	3.39
P	66947	824.7	824.89	0.19	825.40	0.70	826.74	**2.04**	827.17	**2.47**	827.66	**2.96**	828.12	**3.42**
Q	72525	826.74	826.94	0.20	827.49	0.75	828.50	1.76	828.99	2.25	829.50	2.76	829.99	3.25
R	76030	827.84	828.05	0.21	828.65	0.81	829.58	1.74	830.11	2.27	830.64	2.80	831.16	3.32
S	77365	827.93	828.15	0.22	828.74	0.81	829.66	1.73	830.19	2.26	830.72	2.79	831.23	3.30
T	79600	828.64	828.90	0.26	829.56	0.92	830.51	1.87	830.88	2.24	831.45	2.81	832.00	3.36
U	83149	829.12	829.40	0.28	830.10	**0.98**	830.90	1.78	831.30	2.18	831.88	2.76	832.44	3.32
V	83281	829.12	829.40	0.28	830.09	0.97	830.90	1.78	831.30	2.18	831.88	2.76	832.43	3.31
W	87085	829.69	829.95	0.26	830.62	0.93	831.38	1.69	831.81	2.12	832.40	2.71	832.96	3.27
X	90490	830.59	830.76	0.17	831.23	0.64	831.81	1.22	832.19	1.60	832.70	2.11	833.22	2.63
Y	94949	832.21	832.36	0.15	832.74	0.53	833.13	0.92	833.43	1.22	833.78	1.57	834.15	1.94
Z	94981	832.24	832.38	0.14	832.76	0.52	833.15	0.91	833.45	1.21	833.80	1.56	834.17	1.93
AA	98210	832.66	832.81	0.15	833.18	0.52	833.56	0.90	833.86	1.20	834.19	1.53	834.54	1.88
AB	106345	832.71	832.86	0.15	833.24	0.53	833.62	0.91	833.92	1.21	834.25	1.54	834.59	1.88

The differences shown in the preceding two tables is the difference between the proposed water surface elevations based on fully developed conditions and the current FEMA existing conditions elevations; both conditions include the additional wet weather flow from the proposed WRF. It should be noted that these tables include, but do not distinguish, the impact of the wet weather flow of the proposed WRF on the fully developed water surface elevation, estimating the difference between existing FEMA levels and future potential fully developed conditions   A hydraulic analysis was completed previously (refer to memo dated 3/16/2006) for existing conditions. This previous analysis determined that the water surface elevation is increased by approximately 0.32 feet due to the wet weather flows from the proposed WRF

The water surface elevation in bold is the maximum increase in water surface elevation for that particular flow increase.   For example the maximum increase in water surface elevation for the 30 Percent Increase is 2.37 feet when the wet weather flows are discharged at the White Site and it is 2.47 feet when the wet weather flows are discharged at the Purple Site.   The row that is shaded in each table corresponds to the upstream boundary of that particular proposed WRF site.

Based on the results of this analysis it appears that increasing the flows for fully developed conditions could have a considerable impact on the water surface elevation.

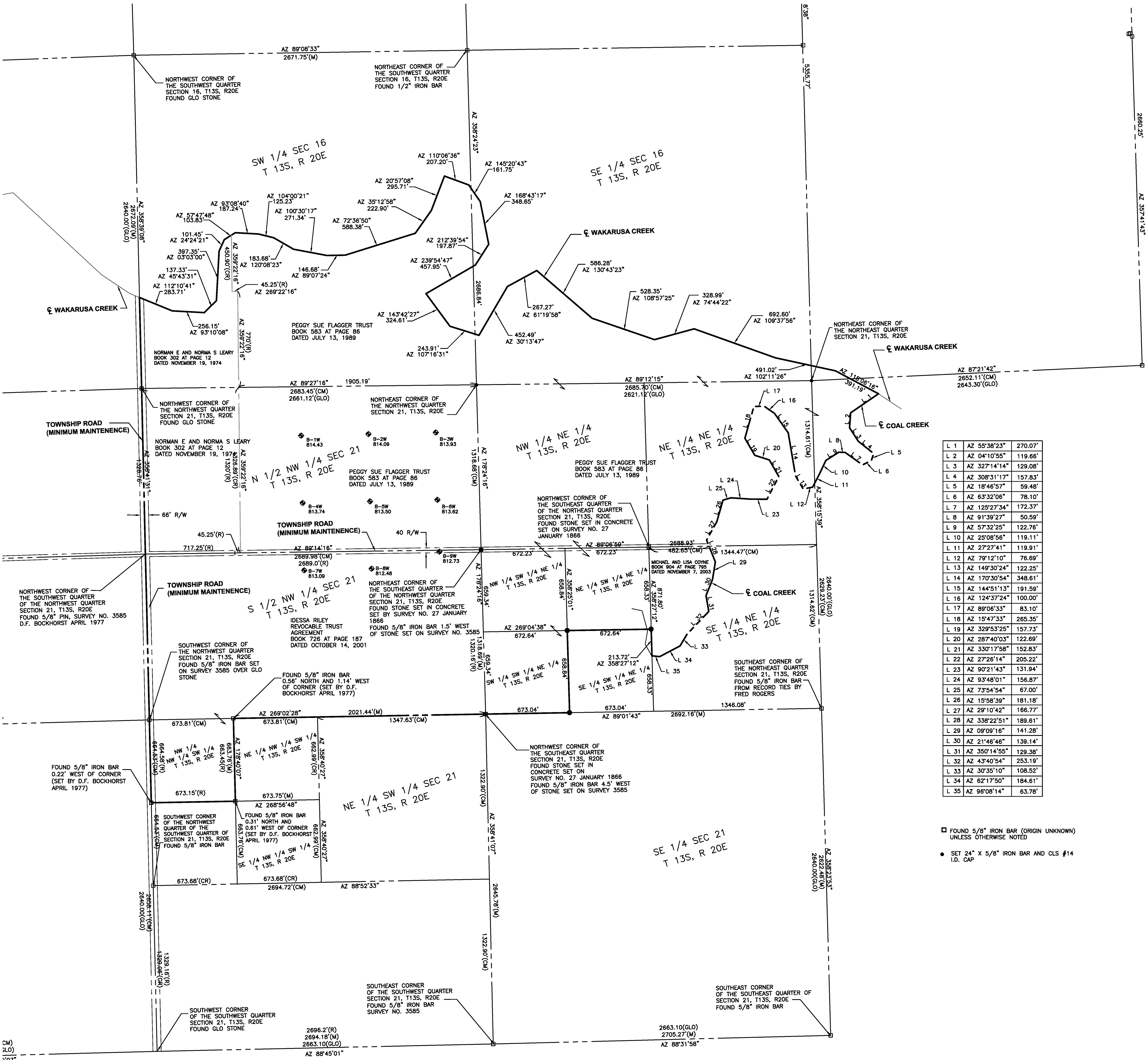
This analysis does not represent any physical impacts from the construction of a new WRF.   Once the preferred WRF site has been selected and the proposed grading and layout information is available, additional hydraulic evaluation will be necessary to determine if the physical location of the WRF site will have an impact on the floodplain water surface elevations.

Johnson County Watershed Studies

Two of Johnson County's watershed studies were reviewed to estimate approximately how much higher the fully developed flows are compared to the existing conditions flows.   The Blue River Watershed Study which was completed by CDM in 2001 was utilized as well as the Marais Des Cygnes Watershed Study which is currently being completed by HNTB and GBA.   Twelve different flows were compared for each watershed study.   The Blue River Watershed Study had fully developed flows which were approximately 42 percent higher than the existing conditions flows.   The Marais Des Cygnes Watershed Study had fully developed flows which were approximately 25 percent higher than the existing conditions flows.   The average would be 33 percent higher than the existing conditions flows.   Both the Blue River Watershed and the Marais Des Cygnes Watershed in Johnson County are predominantly rural, therefore the watershed characteristics are similar to the Wakaursa River Watershed.   This comparison to the Johnson County studies was completed to get a sense for what potential increase in flows one could expect in the Wakarusa River Watershed.   A detailed hydrologic analysis would have to be completed to know more accurate fully developed flows.

Recommendation

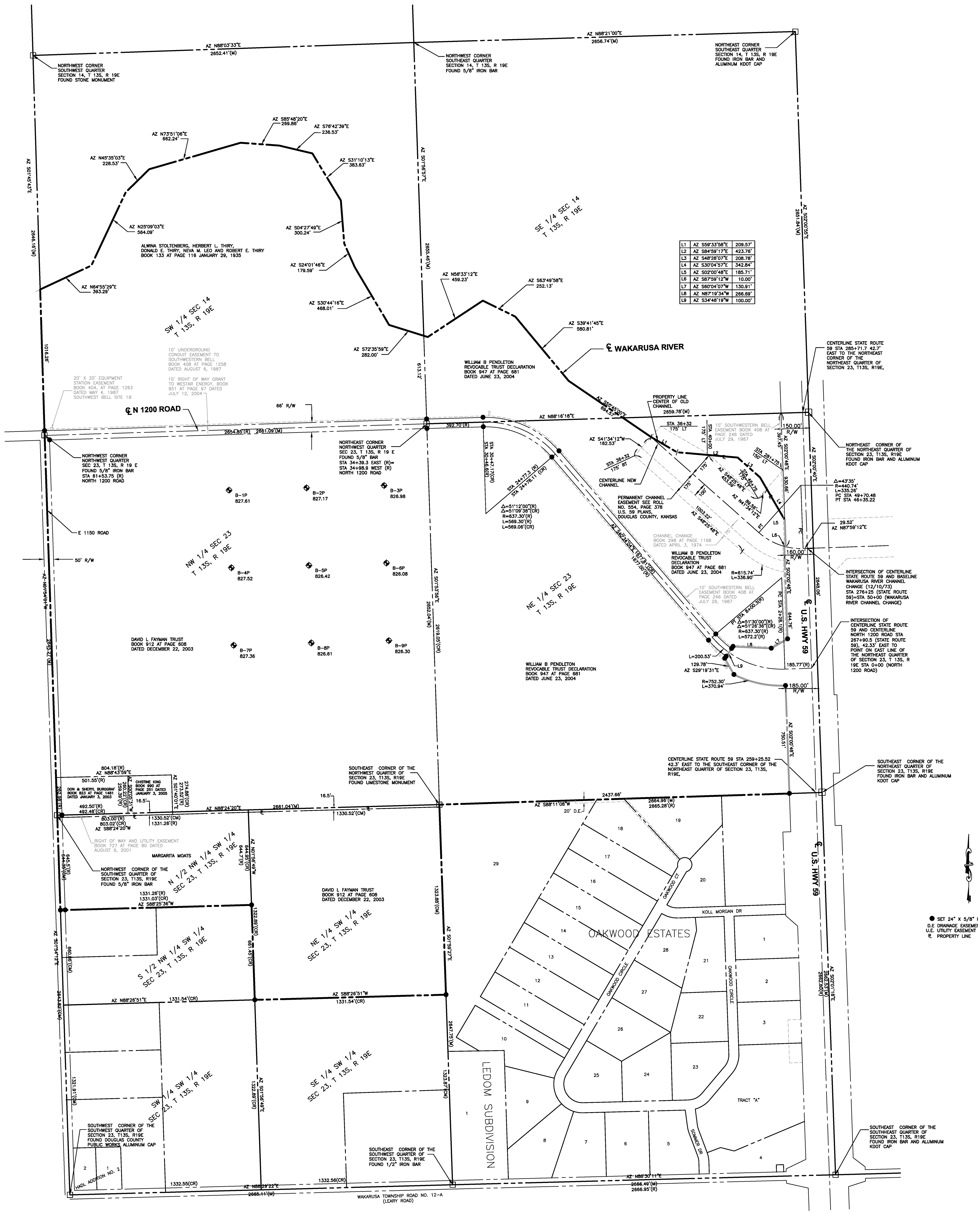
It is recommended that a meeting with the City of Lawrence is held to discuss how much protection against future area development is desired protect the WRF.   The City's Floodplain Management Ordinance regulations should also be discussed, in addition to determining what level of hydrologic and hydraulic analysis will be required for future phases of this project.



L 1	AZ 55°38'23"	270.07'
L 2	AZ 04°10'55"	119.66'
L 3	AZ 327°14'14"	129.08'
L 4	AZ 308°31'17"	157.83'
L 5	AZ 18°46'57"	59.48'
L 6	AZ 63°32'06"	78.10'
L 7	AZ 125°27'34"	172.37'
L 8	AZ 91°39'27"	50.59'
L 9	AZ 57°32'25"	122.76'
L 10	AZ 25°08'56"	119.11'
L 11	AZ 27°27'41"	119.91'
L 12	AZ 79°12'10"	76.69'
L 13	AZ 149°30'24"	122.25'
L 14	AZ 170°30'54"	348.61'
L 15	AZ 144°51'13"	191.59'
L 16	AZ 124°37'24"	100.00'
L 17	AZ 89°06'33"	83.10'
L 18	AZ 15°47'33"	265.35'
L 19	AZ 329°53'25"	157.73'
L 20	AZ 287°40'03"	122.69'
L 21	AZ 330°17'58"	152.83'
L 22	AZ 27°26'14"	205.22'
L 23	AZ 90°21'43"	131.94'
L 24	AZ 93°48'01"	156.87'
L 25	AZ 73°54'54"	67.00'
L 26	AZ 15°58'39"	181.18'
L 27	AZ 29°10'42"	166.77'
L 28	AZ 338°22'51"	189.61'
L 29	AZ 09°09'16"	141.28'
L 30	AZ 21°46'46"	139.14'
L 31	AZ 350°14'55"	129.38'
L 32	AZ 43°40'54"	253.19'
L 33	AZ 30°35'10"	108.52'
L 34	AZ 62°17'50"	184.61'
L 35	AZ 96°08'14"	63.78'

□ FOUND 5/8" IRON BAR (ORIGIN UNKNOWN) UNLESS OTHERWISE NOTED

● SET 24" X 5/8" IRON BAR AND CLS #14 I.D. CAP



L1	AZ S59°33'58"E	209.57'
L2	AZ S84°59'17"E	423.76'
L3	AZ S48°28'07"E	208.78'
L4	AZ S30°04'57"E	342.84'
L5	AZ S02°00'48"E	185.71'
L6	AZ S87°59'12"W	10.00'
L7	AZ S60°04'07"W	130.91'
L8	AZ N87°19'34"W	266.69'
L9	AZ S34°48'19"W	100.00'

Appendix G

Ratings Summary Results

<u>Community</u>

Aesthetics

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4 Marginally visible from major highway	**5** Not highly visible from major highway	**5** Not highly visible from major highway	**5** Not highly visible from major highway	**2** Highly visible from major highway/gateway to the city	**2** Highly visible from major highway/gateway to the city	**2** Highly visible from major highway/gateway to the city
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2	**3**	**4**	**3**	**1**	**1**	**1**
Location as above, but facility mostly outdoors/larger - rates lower than small						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**5**	**5**	**5**	**2**	**2**	**2**
Location as above, wetland buffer leads to higher rating than medium						

Noise Control

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4 Fewer near neighbors; portions of facility covered	**4** Fewer near neighbors; portions of facility covered	**3** Near neighbors; portions of facility covered	**3** Near neighbors; portions of facility covered	**4** Fewer near neighbors; portions of facility covered	**3** Near neighbors; portions of facility covered	**4** Near ball-field; portions of facility covered
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**3**	**2**	**2**	**3**	**2**	**3**
Neighbors as above; fewer covered portions drops rating below small						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**3**	**3**	**4**	**3**	**4**
Neighbors as above; wetland buffer restores sites to that of the small footprint facility						

Odor Control

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4 Few near neighbors	**1** Valley with plant near property line (based on site topography)	**4** Few near neighbors	**3** Near neighbors	**2** Location bisected by city entrance route	**2** Location bisected by city entrance route	**3** Near ball-field
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**1**	**4**	**3**	**2**	**2**	**3**
Location as above; amount of odor and location of headworks same as for small						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**1**	**4**	**4**	**2**	**2**	**3**
Location as above; wetlands may provide wider buffer on some sites, but amount and location of odor the same as for small						

Prevailing Winds

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2 Northeast wind would impact K-10 corridor	**5** Floodplain provides buffer; northeastern winds should not impact highly populated areas	**5** Floodplain provides buffer; northeastern winds should not impact highly populated areas	**4** Floodplain provides buffer; northeastern winds should not impact highly populated areas, but some near neighbors	**1** Northeastern wind would impact populated areas; narrower floodplain buffer	**2** Northeastern wind would impact populated areas	**1** Northeaster wind would impact populated areas, narrower floodplain buffer
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2	**5**	**5**	**4**	**1**	**2**	**1**
Location dependent, as given above						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2	**5**	**5**	**4**	**1**	**2**	**1**
Location dependent, as given above						

Lighting Control

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4 Few near neighbors	**1** Topography requires plant near property lines	**4** Few near neighbors	**3** Some near neighbors	**2** Gateway to the City	**2** Gateway to the City	**3** Near neighbors, but ball field already lights area to some extent
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2 Few near neighbors	**1** Topography requires plant near property lines	**4** Few near neighbors	**3** Some near neighbors	**2** Gateway to the City	**2** Gateway to the City	**3** Near neighbors, but ball field already lights area to some extent
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3 Few near neighbors	**1** Topography requires plant near property lines	**4** Few near neighbors	**3** Some near neighbors	**2** Gateway to the City	**2** Gateway to the City	**3** Near neighbors, but ball field already lights area to some extent

Traffic Considerations

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4 Good highway access	**1** Poor highway access	**2** Poor highway access	**2** Poor highway access	**4** Good highway access	**4** Good highway access	**4** Good highway access
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**1**	**2**	**2**	**4**	**4**	**4**
Location dependent, as given above						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**1**	**2**	**2**	**4**	**4**	**4**
Location dependent, as given above						

Fit with Current Land Use

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5 Good fit with current vacant/farm use	**3** Current use is vacant/farm/residential – residential use lowers rating	**5** Good fit with current vacant/farm use	**1** Current use is vacant/farm/residential; fairly well developed with residents, significantly lowering rating	**3** Current use is vacant/farming; position at gateway to city lowers rating	**1** Current use is wetlands mitigation for Clinton Reservoir, significantly lowers ranking	**4** Current use is park/residential/farming – residential use lowers rating
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**2**	**4**	**1**	**2**	**1**	**3**
Usage as given above; ratings lowered due to larger size of medium footprint facility						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**2**	**4**	**1**	**2**	**1**	**3**
Usage as given above; ratings same as above due to common conventional facility in medium/large alternatives						

Fit with Future Land Use

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5 Good fit with future use of vacant/farming	**3** Future use is vacant/farming/ residential – future residential use lowers rating in comparison to other sites	**5** Good fit with future use of vacant/farming	**1** Future use is residential – not highly compatible with location of facility	**3** Future use is vacant/farming; position at gateway to city lowers rating	**2** Future use is vacant/farming/ open/park, moving to residential south of N 1200 Rd; Clinton Reservoir mitigation area also lowers rating	**4** Park/residential/farming – presence of ball field
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**3**	**5**	**1**	**2**	**1**	**3**
Future land use as above, medium footprint facility is larger and would have a greater impact leading to a lower score						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**2**	**4**	**1**	**2**	**1**	**4**
Future land use as above, larger footprint and wetland buffer provide a trade-off in the rankings for medium and large, depending on site						

School District Boundaries

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2 Site may promote growth within Baldwin School District instead of Lawrence (USD 497) School District	**2** Site may promote growth within Baldwin School District instead of Lawrence (USD 497) School District	**2** Site may promote growth within Baldwin School District instead of Lawrence (USD 497) School District	**3** Central location will likely not impact the balance between Baldwin and Lawrence School Districts	**4** Site may promote growth within Lawrence (USD 497) School District instead of within Baldwin School District	**4** Site may promote growth within Lawrence (USD 497) School District instead of within Baldwin School District	**4** Site may promote growth within Lawrence (USD 497) School District instead of within Baldwin School District
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2	**2**	**2**	**3**	**4**	**4**	**4**
Location dependent, as given above						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2	**2**	**2**	**3**	**4**	**4**	**4**
Location dependent, as given above						

Environment

Stream Impacts

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**5**	**5**	**5**	**5**	**5**	**5**
Technology dependent; small footprint consistently produces the highest quality effluent						
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**4**	**4**	**4**	**4**	**4**
Technology dependent; medium footprint facility is proven by extensive operating history to produce high quality effluent						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**4**	**4**	**4**	**4**	**4**
Technology dependent; performance the same as the medium footprint alternative with additional polishing treatment during certain periods of the year						

Discharge Location

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4 Higher rating based on anticipated public perception of facilities' effluent discharge downstream of the Haskell-Baker Wetlands as a benefit	**4** Higher rating based on anticipated public perception of facilities' effluent discharge downstream of the Haskell-Baker Wetlands as a benefit	**4** Higher rating based on anticipated public perception of facilities' effluent discharge downstream of the Haskell-Baker Wetlands as a benefit	**3** Neutral rating based on anticipated public perception of facilities' effluent discharge directly south of the Haskell-Baker Wetlands	**2** Lower rating based on anticipated public perception of facilities' effluent discharge downstream of the Haskell-Baker Wetlands as a detriment	**2** Lower rating based on anticipated public perception of facilities' effluent discharge downstream of the Haskell-Baker Wetlands as a detriment	**2** Lower rating based on anticipated public perception of facilities' effluent discharge downstream of the Haskell-Baker Wetlands as a detriment
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**4**	**3**	**2**	**2**	**2**
Location dependent, as given above						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**4**	**3**	**2**	**2**	**2**
Location dependent, as given above						

Rare or Endangered Species Impacts

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**5**	**5**	**5**	**5**	**5**	**5**
Footprint dependent in the absence of detailed site specific information (will be gathered in Phase II); smaller footprint rated higher due to lesser space requirements and perceived lower impact						
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2	**2**	**2**	**2**	**2**	**2**	**2**
Footprint dependent in the absence of detailed site specific information (will be gathered in Phase II); medium footprint rated lower than small due to greater space requirements and perceived greater impact						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**4**	**4**	**4**	**4**	**4**
Footprint dependent in the absence of detailed site specific information (will be gathered in Phase II); large footprint rated lower than small due to greater space requirements, but higher than medium footprint because wetland buffer creates a permanent environment for species around the facility						

Archeological/Historical Evidence

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5 No known historical resources present; on-site investigation required to confirm	**5** No known historical resources present; on-site investigation required to confirm	**4** Some historical resources identified on riverbank; on-site investigation required to confirm	**1** Confirmed highly historical area	**5** No known historical resources present; on-site investigation required to confirm	**5** No known historical resources present; on-site investigation required to confirm	**5** No known historical resources present; on-site investigation required to confirm
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**3**	**1**	**4**	**4**	**4**
Location dependent; medium footprint rated lower than small due to greater spatial impact						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**3**	**2**	**1**	**3**	**3**	**3**
Location dependent; larger footprint rated lower than medium due to greater spatial impact						

Existing Floodplain/Wetlands Impacts

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3 Neutral rating due to moderate floodplain impacts	**5** High rating due to minimal floodplain impacts	**3** Neutral rating due to moderate floodplain impacts	**5** High rating due to minimal floodplain impacts	**3** Neutral rating due to moderate floodplain impacts	**1** Low rating due to significant impacts to Clinton Reservoir wetland mitigation area	**3** Neutral rating due to moderate floodplain impacts
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
1	**3**	**1**	**3**	**1**	**1**	**1**
Location dependent; medium footprint rated lower than small due to greater spatial impact						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**5**	**3**	**5**	**3**	**1**	**3**
Location dependent, ratings equal to those for small footprint because even though spatial impact is greater for large footprint than for small or medium site, a portion of the site will permanently set aside for wetlands cultivation						

Biodiversity

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**5**	**5**	**5**	**5**	**5**	**5**
Footprint dependent in the absence of detailed site specific information (will be gathered in Phase II); smaller footprint rated higher due to lesser space requirements and perceived lower impact						
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2	**2**	**2**	**2**	**2**	**2**	**2**
Footprint dependent in the absence of detailed site specific information (will be gathered in Phase II); medium footprint rated lower than small due to greater space requirements and perceived greater impact						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**4**	**4**	**4**	**4**	**4**
Footprint dependent in the absence of detailed site specific information (will be gathered in Phase II); large footprint rated lower than small due to greater space requirements, but higher than medium footprint because wetland buffer creates a permanent environment for species around the facility						

Land

Displacement of Housing

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5 No homes on site	**4** 1 home on site	**5** No homes on site	**5** No homes on site	**4** 2 homes on site	**4** 1 home on site	**5** No homes on site
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5 No homes on site	**4** 2 homes on site	**4** 3 homes on site	**4** 3 homes on site	**1** More than 10 homes on site	**4** 2 homes on site	**5** No homes on site
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**1**	**1**	**1**	**1**	**1**	**5**
No homes on site	More than 10 homes on site	More than 10 homes on site	More than 10 homes on site	More than 10 homes on site	More than 10 homes on site	No homes on site

Future Service Area by Gravity

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
1 Can service southeast area	**4** Potential of 30,000 acres	**3** Potential of 25,000 acres	**2** Potential of 8,000 acres	**5** Potential of 36,000 acres	**4** Potential of 28,000 acres	**1** Can service northwest area
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
Can service southeast area	**4**	**3**	**2**	**5**	**4**	Can service northwest area
Location dependent; potential gravity service acreage does not depend on size of facility, but position within the watershed						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
Can service southeast area	**4**	**3**	**2**	**5**	**4**	Can service northwest area
Location dependent; potential gravity service acreage does not depend on size of facility, but position within the watershed						

Usability/Shape

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5 High rating due to flexibility of site	**2** Long and skinny site reduces rating	**5** High rating due to flexibility of site	**1** Historical resources in the area decrease the usability of the site	**5** High rating due to flexibility of site	**3** Lower ranking due to less flexibility than some of the sites; relocation of highway likely required	**4** Lower ranking due to less flexibility than some of the sites
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5 High rating due to flexibility of site – even for larger footprint	**1** Flexibility of long and skinny site is further reduced for larger footprint	**5** High rating due to flexibility of site – even greater for larger footprint	**1** Historical resources in the area decrease the usability of the site – even greater for larger footprint	**2** Highway bisects site for larger footprint – likely to require facility to be shifted south of N 1200 Rd	**1** Highway bisects site; larger footprint to definitely require relocation of the highway	**3** Flexibility for this site is further reduced by larger footprint
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**1**	**3**	**1**	**1**	**1**	**2**
High rating due to flexibility of site – even for large footprint	Flexibility of long and skinny site is even further reduced for large footprint	Flexibility of this site is further reduced by large footprint	Historical resources in the area decrease the usability of the site – even greater for larger footprint	Highway bisects site for larger footprint – likely to require facility to be shifted south of N 1200 Rd; would require extensive displacement of homes	Highway bisects site; large footprint to definitely require relocation of the highway	Flexibility for this site is further reduced by large footprint

Maximizes Use of Existing Infrastructure

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3 Closer to existing WWTP to allow flexibility in solids management, but further from connection point to existing collection system	**3** Closer to existing WWTP to allow flexibility in solids management, but further from connection point to existing collection system	**4** Rated higher due to more centralized location; offers proximity to existing plant and collection system	**4** Rated higher due to more centralized location; offers proximity to existing plant and collection system	**3** Further from existing WWTP reducing flexibility in solids management, but closer to connection point to existing collection system	**3** Further from existing WWTP reducing flexibility in solids management, but closer to connection point to existing collection system	**3** Further from existing WWTP reducing flexibility in solids management, but closer to connection point to existing collection system
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**3**	**4**	**4**	**3**	**3**	**3**
Location dependent; site footprint does not influence the proximity/utilization of existing infrastructure						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**3**	**4**	**4**	**3**	**3**	**3**
Location dependent; site footprint does not influence the proximity/utilization of existing infrastructure						

Process

Proven Treatment Technology

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**3**	**3**	**3**	**3**	**3**	**3**
Process technology, not site location, dependent; while proven, small footprint technology has fewer installations (none in Kansas)						
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**5**	**5**	**5**	**5**	**5**	**5**
Process technology, not site location, dependent; many operational installations and a highly proven technology						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**4**	**4**	**4**	**4**	**4**
Process technology, not site location, dependent; conventional portion of treatment highly proven, but wetlands components introduces additional uncertainty						

Future Regulatory Compliance

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**5**	**5**	**5**	**5**	**5**	**5**
Process technology, not site location, dependent; small footprint technology is able to meet envisioned future regulations						
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**3**	**3**	**3**	**3**	**3**	**3**
Process technology, not site location, dependent; medium footprint technology likely to require new processes to meet future regulations						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
2	**2**	**2**	**2**	**2**	**2**	**2**
Process technology, not site location, dependent; similar to the conventional technology, large footprint technology is likely to require new processes to meet future regulations. However, the wetlands component adds an element of uncertainty, causing the large footprint to be rated lower than the medium.						

Operations and Maintenance

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**3**	**3**	**3**	**3**	**3**	**3**
Process technology, not site location, dependent; small footprint technology was ranked lower because it is an unfamiliar process for the City. Also, the process is highly automated and mechanical, typically requiring more maintenance efforts.						
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**5**	**5**	**5**	**5**	**5**	**5**
Process technology, not site location, dependent; conventional technology is familiar for City personnel, leading to efficiencies in O&M						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**3**	**3**	**3**	**3**	**3**	**3**
Process technology, not site location, dependent; conventional portion of technology is familiar, but the wetlands provides a less familiar process component requiring additional O&M outside the expertise of plant operations personnel (for example horticulturists, etc.)						

Expandability

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**5**	**5**	**5**	**5**	**5**	**5**
Process technology, not site location, dependent; small footprint is more modular allowing highly flexible expansion options						
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4	**4**	**4**	**4**	**4**	**4**	**4**
Process technology, not site location, dependent; conventional technology must expand in finite increments, resulting in less flexibility and a lower rating						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**1**	**1**	**1**	**1**	**1**	**1**
Process technology, not site location, dependent; large footprint technology is ranked lower than medium due to greater space requirements for expansion of wetlands. The majority of large footprint sites are ranked at the bottom of the range because the sites simply do not provide enough space to allow for expansion beyond the already large footprint						

Schedule

Land Acquisition

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4 Approximately 2 property owners	**5** Approximately 1 property owner; fewer negotiations	**4** Approximately 3 property owners	**4** Approximately 2 property owners	**4** Approximately 1 property owner	**4** Approximately 2 property owners	**5** Approximately 1 property owner; fewer negotiations
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3 Approximately 4 property owners	**4** Approximately 3 property owners	**3** Approximately 5 property owners	**3** Approximately 5 property owners	**4** Approximately 2 property owners	**4** Approximately 2 property owners	**5** Approximately 1 property owners
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
1	**1**	**1**	**1**	**1**	**1**	**1**
More than 10 owners, ranked low due to large number of negotiations necessary	More than 10 owners, ranked low due to large number of negotiations necessary	More than 10 owners, ranked low due to large number of negotiations necessary	More than 10 owners, ranked low due to large number of negotiations necessary	More than 10 owners, ranked low due to large number of negotiations necessary	More than 10 owners, ranked low due to large number of negotiations necessary	Not enough land available

Permitting

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4 No installations of small footprint technology in Kansas at this time; will require floodplain mitigation	**5** No installations of small footprint technology in Kansas at this time	**4** No installations of small footprint technology in Kansas at this time; will require floodplain mitigation	**1** Ranked low due to the presence of historical resources on site	**4** No installations of small footprint technology in Kansas at this time; will require floodplain mitigation	**1** Ranked low due to the presence of the Clinton Reservoir wetland mitigation area	**4** No installations of small footprint technology in Kansas at this time; will require floodplain mitigation
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
4 Will require floodplain mitigation	**5** No floodplain mitigation required	**4** Will require floodplain mitigation	**1** Ranked low due to the presence of historical resources on site	**4** Will require floodplain mitigation	**1** Ranked low due to the presence of the Clinton Reservoir wetland mitigation area	**4** Will require floodplain mitigation

Permitting (continued)

Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**4**	**3**	**1**	**3**	**3**	**4**
Ranking lowered from that for medium or small footprint due to significantly increased acreage to permit; wetlands component is less familiar to permit	Ranking lowered from that for medium or small footprint due to significantly increased acreage to permit; wetlands component is less familiar to permit	Ranking lowered from that for medium or small footprint due to significantly increased acreage to permit; wetlands component is less familiar to permit	Ranked low due to the presence of historical resources on site	Ranking lowered from that for medium or small footprint due to significantly increased acreage to permit; wetlands component is less familiar to permit	Ranking for large footprint facility at this site is higher than for other footprints since a portion of the site will be set aside permanently for wetlands cultivation	Ranking lowered from that for medium or small footprint due to significantly increased acreage to permit; wetlands component is less familiar to permit

Design/Construction

Small						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
1	**1**	**1**	**1**	**1**	**1**	**1**
Primarily process technology driven; small footprint is ranked low due to need for less efficient, compact construction						
Medium						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
5	**5**	**5**	**5**	**5**	**5**	**5**
Primarily process technology driven; medium footprint is ranked highest due more disperse construction						
Large						
Green	**Yellow**	**White**	**Blue**	**Purple**	**Red**	**Orange**
3	**3**	**3**	**3**	**3**	**3**	**3**
Primarily process driven; large footprint ranked lower than medium footprint due to additional effort and time it takes to establish the wetlands portion						