# Parsons Brinckerhoff Value Engineering

# P.B.V.E.

P.B. VALUE STUDY NO. 02-21

CONDUCTED FOR: **Flood Control District of Maricopa County**

SUBJECT: Chandler Heights and Rittenhouse (EMF) Detention Basins

DATES: July 31 and August 1, 2002

TEAM MEMBERS:

- Paul Stears - - Flood Control District
- Scott Vogel - - FCD
- Jeff Riddle - - FCD
- Joe Rumann - - FCD
- Ed Loy - - FCD
- Gary Shapiro - - FCD
- George Beckwith - - PE, LLC
- Chris Rasmussen - - Town of Gilbert
- Reg Boucher - - Town of Gilbert
- Barry Ling - - Kirkham Michael
- Charlie Joy - - Kirkham Michael
- Brian Starrett - - Kirkham Michael
- Rod Curtis - - Parsons Brinckerhoff

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# RECOMMENDATIONS AND IMPLEMENTATION PHASE

"WHAT DOES THE TEAM RECOMMEND?"

"WHY?"

A. Recommendations

B. Design Suggestions

# A. Value Engineering Recommendations

## Recommendation No. 1 - - Enlarge Chandler Heights Basin To The North

### Description

The value engineering team recommends that the area of the Chandler Heights Basin be increased by enlarging it approximately 20 acres to the north. This recommendation would increase the excavation for the basin, and would result in approximately 100 acre-feet of excess storage capacity in the basin. The volume of excavation would be further increased because the existing elevation of the northern portion of the site is higher than the southern portion. This change would allow the Town of Gilbert to place approximately 160,000 cubic yards of earth in the basin for multi-use purposes, such as aesthetic berms. The volume of water stored by the basin would thus not change as a result of this recommendation.

### Feasibility

The Chandler Heights Basin has a high feasibility to be enlarged to the north, but additional basin excavation would be required. This recommendation would provide increased flexibility for landscaping and multi-use functions. Only minimal design change would be required, with impacts to the side weir and drop outlet designs. There is the potential for utility impacts.

### Functionality

The primary function of the basin is to hold a required amount of water during high-flow events. The secondary function is to provide multi-use opportunity. Enlarging the basin would allow for increased flexibility in multi-use, while retaining the same volume of stormwater, thus maintaining or enhancing both functions.

### Life-Cycle Cost

This recommendation would require an additional initial expenditure for excavation, R/W, and landscaping. There would be a negligible impact on O&M costs.

## Recommendation No. 2 - - Dirt Removal Alternatives

### Description

The V.E. Team recommends that the District actively pursue the sale and/or removal of the earth in both basins. The existing process of auctioning would not allow the District to pay for the removal, but the agency could allow it to be removed at no cost. We recommend that the process be adjusted such that it will encourage "free dirt". We also recommend that FCD allocate a full-time position for the purpose of managing the removal of this dirt. This process could be extended over a five-year period or until adequate funds become available to construct the remainder of the basin.

### Feasibility

FCD has procedures in place to auction dirt. Legal issues related to advertising "free dirt" need to be explored, as well as interagency cooperation with ADOT in the construction of the Santan Freeway, and developers across the Valley.

### Functionality

This recommendation would not change any project functions.

### Life-Cycle Cost

This recommendation would reduce construction cost by having the excavation performed at no cost to FCD. There would be no impact on O&M costs. The use of a full-time coordinator would increase the overall savings.

# Recommendation No. 3 - - Minimize Interim Planting and Size Irrigation For The Future

## Description

This recommendation proposes to minimize the initial landscape plan and provide appropriate irrigation capacity for future needs.

## Feasibility

Technical feasibility is not an issue with this recommendation. The Team believes that this change would be acceptable to the various stakeholders.

## Functionality

This recommendation would continue to provide the required functions of the landscaping element. ("Meets Regulation and Policy")

## Life-Cycle Cost

Construction cost would be modestly increased, despite a decrease in landscaping costs, in order to provide the increased irrigation capacity for the future. Operating and maintenance costs would be reduced.

## Recommendation No. 4 - - RWCD and Reclaimed Water

### Description

This recommendation proposes the use of RWCD and reclaimed water for the purpose of irrigation.

### Feasibility

An APP permit from the Arizona Department of Environmental Quality may be required. This recommendation would be environmentally friendly and thus would likely be very acceptable to the stakeholders. Technical feasibility would not be an issue.

### Functionality

This recommendation would enhance the required project functions - ("Encourages Multi-use"; "Enhances Basins"; "Meets Future and Present Regs/Policies"; "Attracts Community")

### Life-Cycle Cost

This recommendation would somewhat increase capital and O&M costs, but would reduce water costs. The savings in water costs would need to be negotiated with the RWCD and the Town of Gilbert, but would be considerable over the life of the project. Maintenance costs could increase due to the use of reclaimed or irrigation water.

## B. Design Suggestions

1. Geomembrane - The V.E. Team suggests that the extent, location, and/or need to reinforce embankments/levees against seepage, cracking, piping and/or damage due to animal activity is best addressed by management personnel. They can assess the amount of risk they are willing to tolerate in conjunction with the recommendations made by experts, and based on more detailed and technical investigation.

   Specifically, the Team suggests that consideration be given to redesigning the basin layouts such that the crest width between the basin and the adjacent channel is approximately 75', which might eliminate the need for a geomembrane.

   Additionally, the thickness of the membrane could be reduced from a 100 mil HDPE product to one of 60 mils.

   Potentially, the geomembrane could be replaced with a geotextile filter to achieve economic savings. As seepage begins, a filter cake quickly builds up on the up-gradient side of the filter, blocking significant flow. Thus the geotextile would serve the same function of a hydraulic barrier as the baseline product. The geotextile would cost about one-third as much as the geomembrane.

   The Team suggests also that the geomembrane be extended only to the Basin/Channel water surface elevation.

2. Sluice Gates - - We suggest that the Design Team attempt to find a way to eliminate the need for sluice gates, in order to minimize maintenance requirements.

3. Tide-Flex Flap Gates - - The VE Team suggests the consideration of the Tide Flex brand of flap gate. These may be less costly than the baseline and also may be better suited to handle the presence of debris.

4. Pedestrian and Vehicular Access - - Future multi-use activities would be facilitated if more such access was provided.

5. Multiple Low Points In Basin - - We suggest consideration of providing multiple low points in the basins, to be drained with small pumps. This suggestion could increase the potential for aesthetic treatments and multi-use.

6. Specialized Excavation and Loading Equipment - - The VE Team suggests that FCD investigate the availability and feasibility of such equipment, given the large amount

of excavation and the uniform grades involved. This could be combined with an advertisement of "free dirt" to the public.

7. Alternate Weir Surfaces - - It may be feasible to use alternate materials for the weir surfaces or the drop structures, considering economics, aesthetics, and impact on hydraulic operation. We also suggest that FCD consider the use of surface treatments that will discourage public access and use, and thus minimize liability.

8. Sediment Basin Sizing - - The VE Team suggests that the Design Team reevaluate sediment transport and sedimentation basin sizes and need. Generally, maintenance can be provided on an annual basis or as needed, therefore requiring much smaller basins. Also, due to the expected decrease in sediment load arising from area development, the baseline basins may be oversized.

9. Basin and Channel Aesthetics - - We suggest an attempt to integrate the basin and channel designs to provide a more water-related, riverine-type aesthetic.

10. Drywells - - Drywells could potentially be used to handle nuisance drainage and/or recharge functions.

11. Maintenance Ramps - - The VE Team suggests that the number of such ramps be reduced to a low as two per basin.

# V.E. Study Record

# PHASE ONE

"WHERE IS THE POTENTIAL FOR VALUE IMPROVEMENT?"

*Value Engineering Overview*

1.A. Describe Subject
1.B. Design Presentation
1.C. Personal Contacts
1.D. Documents Used
1.E. Field Trip (If Applicable) *No Field Trip Conducted*
1.F. Cost Model
1.G. Element/Function/Cost
1.H. FAST Diagram (Optional) *Not Done*
1.I. Elements Selected for Analysis

# Value Engineering Overview

- ✓ V = F/C (Optimize The Relationship Between *Required* Function and *Life-Cycle* Cost)
- ✓ Not "Cost Reduction" -per se (No Quotas!)
- ✓ Search For The "Second Right Answer" (Not a Peer Review, Design Review, or an Audit !!)
- ✓ Check Agendas At The Door! (But Bring Your Creativity and Teamwork!)
- ✓ The "Big Three Questions" of Value Engineering:
    - Is It Feasible?
    - Would It Provide The Required Function?
    - Would It Have a Lower Life-Cycle Cost?
- ✓ Work Hard and Have Fun!!

P.B.V.E.

# IDENTIFY POTENTIAL

## 1.A. DESCRIBE SUBJECT (Major elements, costs, complexities, problems, constraints)

Project Background

This project involves the construction of two large detention basins along the East Maricopa Floodway, in Gilbert, AZ. The estimated construction cost of both projects is $44.3M, including 15% contingencies. Design is currently at the 30% stage. Key construction items include: Earthwork ($27.7M - - 72% of which $24M is for basin excavation); and Various Hydraulic Structures ($6.1M - - 16% of which $1.8M is for drop structures, $1.6M is for weirs, and $1.3M is for membrane.).

Value Engineering Study Scope

The following constraints to the value study were identified during the kick-off meeting:

- Basin locations are set and cannot be significantly altered.
- The hydrology model and resulting volumes are a given for the purpose of this study.
- Mike Ellegood, FCD Director, asked the team not to focus entirely on the technical functions but to keep in mind that the basins need to fit into the overall community.

In addition to these specific constraints, the V.E. Team was constrained by the "Big Three Questions" of value engineering: Would It Work? Would It Provide All Required Function? and Would It Have A Lower Life-Cycle Cost? To the best of its ability, the Team was to determine that the answer to all three questions is YES, or would likely be so upon further investigation, before making a Recommendation for project change. Ideas that did not rise to the level of Recommendations, but which are of interest to the V.E. Team, have been offered as Design Suggestions. All other ideas were dropped.

Summary of Basin Projects (Provided by Paul Stears)

The East Maricopa Floodway (EMF) is a regional flood control channel located in eastern Maricopa County and northern Pinal County. It serves as a primary outfall and flood conveyance for the City of Mesa, Town of Gilbert, Town of Queen Creek, Gila Indian Community, and for unincorporated areas of Maricopa and Pinal Counties, as shown in the map in Figure 1. The Flood Control District of Maricopa County (FCDMC) has determined the need for two large detention basins along the EMF to attenuate peak flood flows; one located north of Chandler Heights Road and the other located north of Rittenhouse Road.

In June 2001, the FCDMC contracted with Kirkham Michael & Associates, Inc. (KM) to initiate the preliminary design of the Chandler Heights and the Rittenhouse Road Detention Basins and ultimately develop final construction plans.

Project Location
The Rittenhouse Detention Basin and Chandler Heights Detention Basin are located in eastern Maricopa County in the Town of Gilbert. The Rittenhouse Detention Basin is bounded by Power Road to the east, the Rittenhouse Channel to the southwest and the EMF to the west. Williams-Gateway Airport and the ASU East campus are located to the east of Power Road in the previous Williams Field Air Force Base. The Chandler Heights Detention Basin is bounded by Higley Road to the east, Chandler Heights Road to the south, and by the EMF to the west.

Project Goals
Based on previous studies, FCDMC has identified a need to mitigate capacity deficiencies in the EMF and subsequently acquired land for the Rittenhouse Basin and the Chandler Heights Basin upon which to construct detention storage basins and associated works. The concept is to temporarily store a portion of the flood volume and release it after peak flows in the EMF have subsided. Diversion of a portion of the flow into storage will reduce the flow downstream, so that capacity limitations are eased. Stored flows should be released within 36 hours after the end of the storm event so that the storage basins do not become semi-permanent aquatic environments.

Project design conditions

This project is designed for the future (year 2020) development conditions. Peak flows for the future conditions are expected to be less than the existing conditions due to the construction of on-site detention and retention facilities required for future land development. In addition, the future conditions include planned capital improvement projects for flood control that should also reduce peak flow rates. Consequently, the proposed project facilities may experience higher flow rates than the design flow rates and may not attenuate flow to the design criteria until planned development and capital improvement projects are constructed.

The site for the Rittenhouse Basin comprises approximately 160 acres and the site for the Chandler Heights Basin comprises approximately 300 acres —both sites are a sizable area for flood detention. By comparison, common detention basins associated with specific developments are usually on the order of 1-20 acres.

Both basins are designed as off-line basins. The Rittenhouse Basin is sized to store approximately 575 acre-feet (for a 100-yr event). The side weir elevation is set to allow a 10-year event to bypass the basins. Above the 10-year event, storm water begins filling the basin.

The Chandler Heights Basin is sized to store approximately 1300 acre-feet. The side weir elevation is set to allow a 5-year event to bypass the basins. Above the 5-year event, storm water begins filling the lower portion of the basin.

Multi-use opportunities
Because of the size of the detention basins, and the fact that the basins will only temporarily detain water after a significant rainfall event, the basin area is attractive for other compatible uses, such as outdoor recreational facilities. However, while the FCDMC favors multi-use and the design of the basin can provide for and take into consideration multi-use opportunities, the

FCDMC will provide no funds for the design and construction of multi-use facilities. The principal focus of the FCDMC and this design effort is a functioning flood control facility. Multi-use facilities compatible with the flood control facility may be designed and constructed by others, so long as the FCDMC is in agreement and the multi-use facilities do not compromise the operation of the basin for flood control.

In addition, with the proximity of Williams-Gateway Airport to Rittenhouse Basin, any proposed multi-use facilities should limit permanent water features within the basin that would attract birds and possibly interfere with aircraft operations.

The Town of Gilbert has expressed an interest in the recreational development of the basin as a park, a trail system and/or golf course. The Town is currently undertaking preliminary studies to determine if Rittenhouse Basin is suitable for an 18-hole golf course. This project's proposed basin design makes accommodations for a golf course at the basin site. However, the basin is not contoured for a golf course and any proposed changes to the basin shape and configuration to accommodate a golf course will only be agreeable if it can be shown that the changes will not adversely impact the operation of the basin for flood control.

The Roosevelt Water Conservancy District owns the existing Queen Creek Channel and plans to make improvements to it for groundwater recharge. The recharge project is compatible with the flood control project, and portions of our design anticipate the possibility of blending the two.

The basin sites could also be utilized as part of the San Tan Regional Trail. The San Tan Regional Trail is a proposed recreational trail system running along the EMF from north Mesa to the San Tan Mountains. The proposed basin design could easily accommodate the proposed trail.

## 1.B DESIGN PRESENTATION

1. Presenters: A PowerPoint presentation was made by Paul Stears and Barry Ling.

2. Significant Items Discussed:

- Undercapacity of the Eastern Maricopa Floodway, built in the 1980's
- Design capacity of the EMF is 8000 cfs (100 year event)
- Estimated 100 year event flow at this time is 16,000 cfs
- But, this number will decrease as local storm water management efforts come on line; basin sizes will be less to reflect this change.
- Pecos Road alignment will be adjusted in future and Rittenhouse basin will be designed to accommodate.
- Basins will be "offline" - no flow to them until the design flow is reached - 10-year for Rittenhouse and 5-year for Chandler Heights
- For Rittenhouse during 100-year event, 6000 cfs in and 3500 cfs out.
- For Chandler Heights - 16,000 cfs in and 6500 cfs out.
- Basins have been kept shallow to avoid pumping requirement.
- In some areas, the basin slope will be very close to the EMF and seepage could cause failure; membrane will be installed between the two facilities to solve this.
- A low-flow channel will be constructed in the Chandler Heights Basin.
- Basins must drain within 36 hours after an event, per FCD health policy
- Ocotillo Road will cross Chandler Heights basin.
- Recharge of stormwater is a future possibility but not part of this design
- Drops structures will be constructed to keep channel slopes flat.
- Sedimentation basins are planned for clean-out once every 5 years.
- The Sanokai Wash will be relocated to a new entrance into the Queen Creek Wash as part of this project.
- Self-operating flap gates will be used at Rittenhouse, but Chandler Heights will also use sluice gates - requiring manual operation.
- Multi-use opportunities, such as possible golf course, were discussed.

# 1.C. PERSONAL CONTACTS

| A. NAME | ORGANIZATION | PHONE | NOTES |
|---|---|---|---|
| None Noted | | | |
| | | | |
| | | | |
| | | | |

## 1. D. DOCUMENTS USED

- 30% Plans - each basin - Kirkham Michael
- Hydrology/Hydraulics Report — July, 2002 Kirkham Michael
- Pre-Design Study — each basin — December, 2001 and January, 2002 Kirkham Michael
- Calculations and Analyses — each basin - July, 2002 Kirkham Michael
- Aerial mapping of each basin
- 30% Cost Estimate — each basin

## 1.E. FIELD TRIP (or video, film, etc.)

**Significant Observations:**

No Field Trip Was Conducted

# 1.F. COST MODEL (Both Projects – 30% Estimate)

| B. ELEMENT | COST | PERCENT OF TOTAL |
|---|---|---|
| | | |
| Earthwork | $27,738,500 | 72% |
| Basin Excavation | $24,056,000 | |
| Channel and Sed. Basins | $ 3,396,000 | |
| | | |
| Hydraulic Structures | $6,145,550 | 16% |
| Drop Structures | $1,803,000 | |
| Weirs | $1,562,000 | |
| Membrane | $1,346,400 | |
| Structural Embankment | $1,018,850 | |
| | | |
| Landscaping | $3,657,003 | 9% |
| | | |
| Miscellaneous | $ 968,175 | 3% |
| | | |
| TOTAL | $38,509,228 | |
| (Does not include contingencies) | | |
| | | |
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# ELEMENT/FUNCTION/COST/COMPLEXITY MODEL ("EF2C")

| ELEMENT | FUNCTIONS | COSTS Const. | O&M(1-5) | R/W | COMPLEXITY (1-5) |
|---|---|---|---|---|---|
| | | | | | |
| Basin Grading | Reduce Flooding | $24M | 3 | $6M | 2 |
| | Hold Water | | | | |
| | Reduce (Peak) Flow | | | | |
| | Encourage Multi-use | | | | |
| | | | | | |
| Channels | Convey Water | $2M | 3 | $1M | 3 |
| | Drain Basin (Chandler Heights) | | | | |
| | Encourage Multi-use | | | | |
| | | | | | |
| Drop Structures | Control Grade | $2M | 2 | N/A | 4 |
| | Reduce Velocity | | | | |
| | | | | | |
| Side Weirs | Divert Water | $2.5M | 2 | N/A | 5 |
| | Encourage Multi-use | | | | |
| | | | | | |
| Sediment Basins | Facilitate Removal | $1M | 4 | $0.5M | 3 |
| | Prevent Aggregation | | | | |
| | | | | | |
| Outlets | Drain Basins | $0.5M | 2 | N/A | 2+ |
| | Encourage Multi-use | | | | |
| | Control Vectors | | | | |
| | | | | | |
| Aesthetics | Encourage Multi-use | $4.0M | 5 | $1.5M | 2 |
| | Enhance Basins | | | | |
| | | | | | |
| Membrane | Prevent Seepage | $2M | 1 | N/A | 4 |
| | | | | | |
| *Costs Are Approx.* | | | | | |

## 1.I. ELEMENTS SELECTED FOR ANALYSIS (team consensus)

| ELEMENT | SELECTION CRITERIA |
|---|---|
| | |
| BASIN GRADING | High Construction Cost |
| | |
| AESTHETICS | High O&M Cost; Significant Construction Cost |
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| MEMBRANE | High Complexity; Significant Construction Cost |
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NOTE: An Element is a portion of the whole which performs the same function(s), regardless of the method used to provide that function.

# PHASE TWO

"WHAT DOES IT DO?"

"WHAT MUST IT DO?"

2.A. Identify Functions/Costs of Selected Elements

2.B. Identify Opportunities For Value Enhancement

- Eliminate Function?
- Perform Function Another Way?

## 2.A/B. FUNCTION/COST ANALYSIS OF SELECTED ELEMENTS

| ELEMENT/COST | FUNCTIONS | FUNCTION COSTS | Value Enhancement Opportunity? |
|---|---|---|---|
| BASIN GRADING ($30M+/- Const./R/W; O&M Score = 3) | Reduce Flooding ***(Higher Order)*** | | |
| | Hold Water ***(BASIC)*** | $30M | Yes |
| | Reduce (Peak) Flow | | |
| | Encourage Multi-use | Low | |
| | Reduce (Property) Damage | | |
| | Release Water | | |
| | Mitigate Capacity ***(Higher Order)*** | | |
| | Receive Water | | |
| | Avoid Pumping | Add Const.; Reduce O&M | |
| | Generate Dirt | High | |
| | Fit (Available) Site | $12M+/- | |
| | Fit Location | | |
| | Reduce Erosion | | |
| | Facilitate Access | | |
| | Use R/W | $6M+/- | |
| Freeboard Depth | Accommodate Waves | High | |
| | Prevent Overtopping | | |
| | Accommodate Settlement | | |
| | | | |

## 2A/B. FUNCTION/COST ANALYSIS OF SIGNIFICANT ELEMENTS

| ELEMENT/COST | FUNCTIONS | FUNCTION COSTS | Value Enhancement Potential? |
|---|---|---|---|
| AESTHETICS ($5.5M Const./R/W; O&M = 5) | Encourage Multi-use | Low | |
| | Enhance Basins | $4M | |
| | Increase R/W | $1.5M | |
| | Meet Regulations/Policy *(BASIC)* | $5.5M | Yes |
| | Attract Community | | |
| | Limit Liability | | |
| | | | |
| MEMBRANES ($2M Const.; O&M = 1) | Prevent Seepage | | |
| | Create Barrier | | |
| | Slow Gophers | | |
| | Prevent Piping *(BASIC)* | $2M | Yes |
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# PHASE THREE

"WHAT ELSE WILL PROVIDE THE REQUIRED FUNCTIONS?"

Another Size?
Another Shape?
Another Material?
Another Time?
Another Sequence?
Another Quantity?
Another Method?

Least/Most Costly?

## 3. Generate Many Ideas!

A. Individual
B. Ensemble
C. Narrowing (First Cut)

**3. A. IDEA GENERATION PASS AROUND**

Function(s): "Hold Water"; "Meet Regulations"; "Prevent Piping"

Ideas: __*Team Members Generated Numerous Ideas Individually — Those Ideas Have Been Uploaded To The Next Section*

UPLOAD IDEAS TO 3. B.

# 3. B. IDEA GENERATION RECORD

| Idea Description | Score | Retain? |
|---|---|---|
| BASIN GRADING | | |
| 1. Terrace basins | 7 | Yes |
| 2. Eliminate Sanoki sediment pond | 2 | No |
| 3. Eliminate ramps | 2 | No |
| 4. Enlarge basin to enhance multi-use | 6 | Yes |
| 5. FCD to buy "George's loader" and advertise free dirt. FCD to load trucks | 2 | No |
| 6. Go deeper – treat standing water | 1 | No |
| 7. Future water recharge | 7 | Yes |
| 8. Hire Jack Nicklaus to design golf course | 0 | No |
| 9. Provide ample flexibility for future re-grading | 4 | Yes |
| 10. Provide access points for pedestrian and vehicular traffic | 2.5 | DS |
| 11. Provide two-way vehicular (paved) access to support multi-use from public street | 1.5 | DS |
| 12. Deep basins and pump stations | 4 | Yes |
| 13. Build structures as first phase, excavate basins over several years, as demand exists | 5 | Yes |
| 14. Excavate 2/3 of basin(s) footprint and stockpile on other 1/3 | 2 | To #31 |
| 15. 3-cell basin with interconnecting pipes and gates – same storage/smaller volume reduces ex and R/W | 1 | No |
| 16. Package entire job to make economical for 6000 CY/Hr. Holland loader. Complete in 90 days | 1 | No |
| 17. Hire full-time dirt broker | 7 | Yes |
| 18. Load trucks for contractors | 2 | DS |
| 19. Declare "free dirt" | 1 | DS |
| 20. Phase construction – build smaller version first to ease in disposing of material | 2 | No |
| 21. Reduce size of sedimentation ponds | 9 | Yes |
| 22. Reduce number of ramps | 10 | DS |
| 23. Negotiate water recharge credits | 4 | Yes |
| 24. Drywells for nuisance water | 2 | DS |
| 25. Recharge drywells | 3 | Yes |
| 26. Future underdrain and pump system to keep invert dry | 3 | Yes |
| 27. Meander basin slope adjacent to EMF (Rittenhouse) | 5 | No |
| 28. More contouring – small pumps | 1 | DS |
| BASIN GRADING (Continued) | Score | Retain? |

| | | |
|---|---|---|
| 29. Slope basin inverts to create additional low points | 3 | Yes |
| 30. Deeper basin with permanent water feature | 4 | Yes |
| 31. Spoil dirt on excess FCD property - broker later when feas. | 5 | Yes |

AESTHETICS

| | | |
|---|---|---|
| 1. Utilize RWCD canal for irrigation | 5 | Yes |
| 2. Make basin footprint larger and leave soil in basin for golf course mounds | 8 | Yes |
| 3. Increase Chandler Heights size to provide for multi-use (slope) and landscape aesthetics (berming) | 6 | Yes |
| 4. Allow Town of Gilbert to use excess parcel south of Pecos for multi-use | 5 | Yes |
| 5. Minimize planting until multi-use plan fully developed | 6 | Yes |
| 6. Reduce amount of hydroseed mix coverage in bottom of basins | 6 | Yes |
| 7. Allow Town of Gilbert to excavate 1′ below basin floor and use material to build mounds for multi-use -allow drainage to percolate in pervious soils | 4 | Yes |
| 8. FCD to allow for 2″ of imported material on basin bottom | 3 | No |
| 9. FCD to work with TOG on design of multi-use if possible | 3 | No |
| 10. FCD to raise grades on excess properties | 2 | No |
| 11. FCD to provide drain with gate at Chandler Heights to drain multi-use facilities constructed below basin bottom | 2 | No |
| 12. Size irrigation system for future basin landscaping | 5 | Yes |
| 13. Make revisions in irrigation system to connect to reclaimed water line, when available | 6 | Yes |
| 14. No aesthetics on "hard structures" and basin grading; provide aesthetics by visual effects and planting/veg. | 1 | No |
| 15. Alternative materials for structures for aesthetics | 4 | DS |
| 16. Utilize 30% additional R/W for landscape and aesthetics per District policy | 3 | Yes |
| 17. Make recreational features from hard structures | 2 | DS |
| 18. Additional features for aesthetics -gatehouses, turrets, etc | 4 | To No.15 |
| 19. Trees | 0 | No |
| 20. Landscape the EMF | 0 | No |

MEMBRANE

| | | |
|---|---|---|
| 1. Increase distance between EMF channel and basin to eliminate need for membrane | 4 | Yes |
| 2. Eliminate membrane | 7 | Yes |

| MEMBRANE (Continued) | Score | Retain? |
|---|---|---|
| 3. Alternate methods:<br>-possible to collapse soils?<br>-overbuild embankments for settlement<br>-surface treatments?<br>-wider embankments? See No. 1<br>-no membrane -treat as needed<br>-specify soil type in levees -clay? | 5 | Yes |
| 4. Investigate eliminating membrane adjacent to concrete channel | 0 | No |
| 5. Investigate replacing 100 mil center membrane with a 30 mil PVC lining along basin slope | 3 | Yes |
| 6. Eliminate membrane adjacent to Queen Creek channel | 0 | No |
| 7. Soil cement channel slopes | 5 | Yes |
| 8. New EMF bank in basin area - eliminate existing EMF bank | 0 | No |
| 9. Gopher-resistant membrane | 2 | No |
| 10. Extend membrane to basin water surface only | 5 | Yes |
| 11. Soil cement on EMF side; liner on other side | 6 | Yes |
| 12. Eliminate membrane along EMF | 7 | Yes |

# PHASE FOUR

"WILL IT WORK?"

"WILL IT PROVIDE THE REQUIRED FUNCTIONS?"

"DOES IT HAVE A LOWER LIFE-CYCLE COST?"

4.A. Grouping
4.B. Matrix Analysis
4.C. Advantages/Disadvantages

# EVALUATE FEASIBILITY

## 4.A. GROUPING - GROUP RETAINED IDEAS INTO CATEGORIES FOR FURTHER ANALYSIS

| NO. | CATEGORY DESCRIPTION | IDEAS INCLUDED (LIST NUMBERS ONLY) |
|---|---|---|
| | | |
| | Basin Grading (Barry, Gary, Jeff, and Reg) | 1,4,7,9,12,13,17,21,23,25,26,29,30,31 |
| | | |
| | Aesthetics (Ed, Paul, Chris, Brian) | 1-7,12,13,16 |
| | | |
| | Membrane (George, Joe, Scott, Charlie) *(Team decided to incorporate remaining membrane ideas into one Design Suggestion)* | 1,2,3,5,7,10,11,12 |
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Over a Century of Engineering Excellence

# 4.B. IDEAS COMPARISON MATRIX (Second Cut)

Category: BASIN GRADING

Criteria: *Key: Feasible? Functional? L.C.C.?*

A. Aesthetics

B. Life-cycle Cost

C. Multi-use Impact

D. Feasibility

E.

F.

G.

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | Aor B? |
| | | | | | B or C? | Aor C? |
| | | | | C or D? | B or D? | Aor D? |
| | | | Dor E? | C or E? | B or E? | Aor E? |
| | | E or F? | Dor F? | C or F? | B or F? | A orF? |
| | F or G? | Eor G? | DorG? | C or G? | B or G? | Aor G? |

| IDEAS | G | F | E | D | C | B | A | Total | Keep? |
|---|---|---|---|---|---|---|---|---|---|
| Scores | | | | 3 | 0 | 2 | 1 | | |
| Weights | | | | 4 | 1 | 3 | 2 | | |
| #12,26,29,30 (Deepen basins and pump) | | | | | | | | 15 | No |
| # 1,4,9 (Enlarge basin) | | | | | | | | 29 | Yes |
| # 7,23,25 (Recharge) | | | | | | | | 35 | Yes |
| # 13,17,31 (Dirt removal) | | | | | | | | 45 | Yes |
| # 21 (Reduce sediment ponds) | | | | | | | | 24 | DS |
| | | | | | | | | | |
| | | | | | | | | | |

# 4.B. IDEAS COMPARISON MATRIX (Second Cut)

Category: Aesthetics

Criteria: *Key: Feasible? Functional? L.C.C.?*

A. Public Acceptance

B. O&M Impact

C. Constructability/Economics

D. Flexibility

E.

F.

G.

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | Aor B? |
| | | | | | B or C? | Aor C? |
| | | | | C or D? | B or D? | Aor D? |
| | | | Dor E? | C or E? | B or E? | Aor E? |
| | | E or F? | Dor F? | C or F? | B or F? | A orF? |
| | F or G? | Eor G? | DorG? | C or G? | B or G? | Aor G? |

| IDEAS | G | F | E | D | C | B | A | Total | Keep? |
|---|---|---|---|---|---|---|---|---|---|
| Scores | | | | 0 | 1 | 3 | 2 | | |
| Weights | | | | 5 | 8 | 10 | 9 | | |
| # 2-4, 7, 16 (Increase basin size for multi-Use and aesthetics) | | | | | | | | 101 | Yes |
| # 5,6,12 (Minimize planting in interim - Size irrigation for future) | | | | | | | | 134 | Yes |
| # 1,13 (RWCD and reclaimed water) | | | | | | | | 110 | Yes |
| | | | | | | | | | |
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## 4.C. THIRD CUT - LIST CATEGORIES/IDEAS, IDENTIFY ADVANTAGES AND DISADVANTAGES.

***Key: Impact on Feasibility, Functionality, Life-Cycle Cost !!***

| CATEGORY/IDEAS | ADVANTAGES | DISADVANTAGES | RETAIN? |
|---|---|---|---|
| | | | |
| **Basin Grading** | | | |
| | | | |
| Enlarge Basin | Future aesthetic mounding | More export | Yes |
| (1,4,9) | Increases multi-use area | Decreases top dry land | |
| | Provides gentler side slopes | Increases low wet land | |
| | | Increases cost | |
| Recharge | Future possibility | Huge interagency coordination | No |
| (7,23,25) | | | |
| | | | |
| Dirt Removal | Cost savings | Scheduling with other projects | Yes |
| (13,17,31) | Makes project feasible | | |
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## 4.C. THIRD CUT - LIST CATEGORIES/IDEAS, IDENTIFY ADVANTAGES AND DISADVANTAGES.



***Key: Impact on Feasibility, Functionality, Life-Cycle Cost !!***

| CATEGORY/IDEAS | ADVANTAGES | DISADVANTAGES | RETAIN? |
|---|---|---|---|
| | | | |
| **Aesthetics** | | | |
| | | | |
| Increase basin size for | Serves a dual purpose for the community | Increases construction cost | Yes |
| Multi-use and aesthetics | Increases flexibility in recreational opps. | Increases maintenance cost | |
| (2-4,7,16) | | Reduces availability of multi-use dry areas | |
| | | | |
| Min. planting in interim | Reduces construction cost for planting | Public demand for more park vegetation | Yes |
| And size irrigation for future (5,6,12) | Reduces O&M cost for planting | | |
| | | | |
| RWCD and reclaimed water | Lower cost vs. potable water | Service locations | Yes |
| (1,13) | Environmentally friendly | Small pump station for RWCD | |
| | Satisfies future water conservation require. | Increased O&M costs | |
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