city of austin
Watershed Protection

EII (NCR, PI, AQL) Quality Assurance Project Plan

Project #s 13, 14, 15, 55

Introduction

The Environmental Integrity Index (EII) is a tool to monitor and assess the ecological integrity and the degree of impairment of Austin's watersheds. The EII combines biological and physical criteria with chemical and toxicity data to provide a comprehensive assessment of the structure and integrity of the aquatic ecosystem. The mission of the City of Austin's Environmental Resource Management Division is to protect the water quality in Austin area watersheds. The EII is used in the Department's master plan process to evaluate the current water quality conditions of Austin's watersheds. Because the EII is a cost-effective, comprehensive and direct means of monitoring the health of Austin's receiving waters, it was also incorporated into the City of Austin's National Pollution Discharge Elimination System (NPDES) permit program as a Reasonable and Prudent Measure (RPM) activity. Additional documentation is available in the Environmental Integrity Index Methodology Report.

The goal of the developers of the EII was to produce a quantifiable method for assessing the water quality condition of Austin's urban and non-urban streams and to provide a baseline from which to evaluate our water resources in order to target protective measures. The scoring system is listed below.

EII Scoring System		
Narrative Score	**EII Score Range**	
	Lower	Upper
Excellent	89	100
Very Good	76	88
Good	64	75
Fair	51	63
Marginal	39	50
Poor	26	38
Bad	13	25
Very Bad	0	12

The EII consists of 6 sub-indices. Watersheds will be divided into homogeneous reaches on the basis of existing GIS data and field experience, and one EII site will be selected and sampled to represent conditions within that reach. Methodology for the collection and calculation of the non-contact recreation, physical integrity (habitat) and aquatic life (benthic macroinvertebrates, diatoms) sub-indices are presented in this QAPP.

Project Management

1. Who is the project manager?
   Mateo Scoggins

2. Who is the WMA team representative?
   Chris Herrington

3. What other WPDRD staff are on the committee for this project?
   Andrew Clamann, Martha Turner

4. When will the annual WMA review be completed?
   January

5. When will the project begin/end?
   The project began in 1994, with the first complete sampling of phase I watersheds in 1996. The project is on-going.

Data Objectives

6. What are the study objective(s)?
   Monitor watershed health with a comprehensive index to identify watersheds with decreasing health and isolate probable causes of degradation (in compliance with current fiscal year business plan).

7. In addition to the project committee, who else is interested in the data?
   WP&DRD administration. Mike Kelly (WP&DR) for bankfull width data.

8. What decision(s) will be made from the information obtained? When will the decision(s) be made?
   Impaired watersheds will be identified, and recommendations will be made to other groups for corrective action:
   - Sites with degrading (by at least one EII category) NCR litter scores will be referred to the Keep Austin Beautiful program.
   - Sites with degrading non-contact recreation or physical integrity scores of at least one category will be referred to the departmental master plan committee (Pat Hartigan).
   - Sites with degrading aquatic life scores will be referred to the surface water evaluation team (Mateo Scoggins) for further review.

9. What has been done in the past? Describe project history, list previous related reports or available data.

   Previous Reports:
   Annual reports (Water Watchdog, etc)
   Online watershed fact sheets (http://www.ci.austin.tx.us/watershed/learn_ws.htm)
   SR-03-06: Change in EII values in Austin (1996-2002)
   COA-ERM 1999-05: Environmental Integrity Index Methodology.
   COA-ERM/WRE 1997-03: Environmental Integrity Index Water Quality Assessment Methodology

10. What could be done in the future? List and prioritize potential special studies.
<INSERT TEXT>

Data generation

11. Describe the sampling. What sites will be sampled? In addition to the core parameter list in the SOP manual, what other parameters will be collected? When will sampling occur?
Sites will be sampled on a rotating 3-year cycle. Biological and habitat data will be collected once per year in June.

Benthic macroinvertebrates will be collected by SOP methods, with 3 surbers collected from the top, middle and bottom of the riffle and composited, with sub-sampling for high-abundance samples. **FOR PHASE III WATERSHEDS ONLY,** if no suitable riffle can be found for surber sampling, benthic samples will be collected for 3 man-minutes by RBA protocol from roots, logs, plants, undercut banks and snags.

Diatoms rock scrapings will be collected from three rocks collected from the top, middle and bottom of the riffle and composited, as documented in the SOP manual. Additionally, densiometer readings will be made to estimate percent canopy cover at each riffle where diatom samples are collected. Three readings will be collected at each site, holding the densiometer out from the hip and level.

Each year two or more reference sites will be sampled for benthic macroinvertebrates and diatoms, either as part of the current Phase or in addition to it (at least until reference conditions are well defined for the conditions prevalent during and prior to the sampling date). The following bank of reference sites has been selected based on staff experience and percent impervious cover.

1. Barton Creek at Shield Ranch (West) - 46
2. Barton Creek at Hwy 71 (West) - 48
3. Bull Creek at Franklin's Tract (West) - 349
4. Bull Creek at St. Ed's Park (West) - 920
5. Onion Creek at Hwy 150 (West) - 612
6. Onion Creek at Twin Creeks (East) - 236
7. Onion Creek at South Austin Regional (East) - 1366
8. Walnut Creek at Old Manor (East) - 502

Non-contact recreation scores are recorded on the Recreational Use Field Assessment Form through field observation. The NCR assessment includes the creek and the adjacent stream banks approximately 100 meters upstream and 100 meters downstream of each site and the visible area of each stream bank. Field assessment forms include a description of the conditions for six parameters in four scoring categories: Excellent, Good, Poor and Bad. Parameters are ranked on a 20-point scale that represents the overall conditions of stream bank at that site.

Field teams will complete the physical integrity field assessment sheet developed by Barbour and Striblings (1998) describing four categories of conditions (optimal, suboptimal, marginal and poor) for each of the following parameters: epifaunal substrate/available cover, embeddedness, velocity/depth regime, sediment deposition, channel flow status, channel alteration, frequency of riffles, banks stability, vegetation protection and riparian vegetative

zone width. In addition, the Pfankuch Channel Stability Evaluation (Figure 4) will be non-scoring supplementary information.

For 2006 through 2008 samples, bankfull width will be measured at all sites with a tape measure.

Phase I - (sites monitored in Year 2003, 2006, 2009, etc)

Highlighted sites are sediment sites

Watershed	Reach	Site Name	FSDB #
Barton	BAR1	Barton Creek Between Dams Above Pool	879
	BAR2	Barton Creek @ Lost Creek Blvd	51
	BAR3	Barton Creek @ Ogletree	49
	BAR4	Barton Creek @ Hwy 71 Below Little Barton (BC0)	48
Blunn	BLU1	Blunn Creek @ Riverside Drive	180
	BLU2	Blunn Creek Above Stacy Pool	364
	BLU3	Blunn Creek @ Long Bow (Preserve at Little Bridge)	362
North Boggy	BOG1	North Boggy Creek @ Delwau Dr.	493
	BOG2	North Boggy Creek @ Nile Road	837
	BOG3	North Boggy Creek @ Manor Road	2754
Buttermilk	BMK1	Buttermilk Creek @ Little Walnut Creek	851
	BMK2	Buttermilk Creek @ Providence Ave	782
	BMK3	Buttermilk Creek @ Victory Christian Center	3861
E. Country Club	ECC1	East Country Club @ ACC	1475
W. Country Club	WCC1	West Country Club @ Kreig Field	1474
	WCC2	West Country Club Creek @ East Oltorf	850
East Bouldin	EBO1	East Bouldin Creek @ Post Oak	1338
	EBO2	East Bouldin Creek @ Elizabeth St	119
	EBO3	East Bouldin Creek Dwnstrm of Alpine Rd	121
Fort Branch	FOR1	Fort Branch Creek @ North Boggy Creek	123
	FOR2	Fort Branch Creek @ Carson Hill Rd	898
	FOR3	Fort Branch Creek Above Manor Rd	125
	FOR4	Fort Branch @ Glencrest	126
Harper's Branch	HRP1	Harper's Branch @ Woodland	844
Johnson Creek	JOH1	Johnson Creek @ Woodmont	897
Little Walnut	LWA1	Little Walnut Creek @ US183	634
	LWA2	Little Walnut Creek @ Cameron Rd	3857
	LWA3	Little Walnut Upstream of IH35	3860
	LWA4	Little Walnut Creek @ Golden Meadow Rd	838
Shoal	SHL1	Shoal Creek Above 1st St.	122
	SHL2	Shoal Creek @ 24th Street	116
	SHL3	Shoal Creek @ Shoal Edge Court (EII)	117
	SHL4	Shoal downstream of Cross Creek	118
Tannehill	TAN1	Tannehill Creek @ Desirable Drive	1476
	TAN2	Tannehill Creek @ Lovell Drive	843
	TAN3	Tannehill Creek @ Berkman Dr	3858
Waller	WLR1	Waller Creek Below Cesar Chavez	38
	WLR2	Waller Creek @ 23rd St. (USGS)	624
	WLR3	Waller Creek @ 51st Street	780
Walnut	WLN1	Walnut Creek @ SP Railroad Bridge	503
	WLN2	Walnut Creek @ Old Manor	502
	WLN3	Walnut Creek Below IH35	464
	WLN4	Walnut Creek @ Metric	895
	WLN5	Wells Branch @ Walnut Metro Park	463
West Bouldin	WBO1	West Bouldin Creek @ Post Oak	2794
	WBO2	West Bouldin Creek @ Oltorf	3854

	WBO3	West Bouldin Creek @ Cardinal & Locke	3856
Williamson	WMS1	Williamson Creek @ McKinney Falls (Will1)	223
	WMS2	Williamson Creek @ IH35 (EII)	491
	WMS3	Williamson Creek @ Hwy 71 (EII)	490

Phase II - (sites monitored in Year 2004, 2007, 2010, etc)

Watershed	Reach	Site Name	FSDB #
Bear Creek	BER1	Bear Creek @ Twin Creeks Road	1087
	BER2	Bear Creek @ Escondido	3935
	BER3	Bear Creek @ Bear Creek Pass	4112
Bee Creek	BEE1	Bee Creek @ Lake Austin	319
	BEE2	Bee Creek @ Road Runner Road	322
	BEE3	Bee Creek @ Loop 360	1104
Bull Creek	BULL1	Bull Creek Above West Bull Creek	347
	BULL2	Bull Creek @ St. Edwards Park above dam	920
	BULL3	Bull Creek Above Trib 7 (Franklin)	349
Carson Creek	CAR1	Carson Creek @ Shady Spring Subdivision	1094
	CAR2	Carson Creek @ Hoecke Lane	1096
Dry Creek (North)	DRN1	Dry Creek (North) @ Mt Bonnel Rd	1108
	DRN2	Dry Creek (North) @ FM 2222	1109
Eanes Creek	EAN1	*no flow, no sampling in reach*	
	EAN2	Eanes Creek @ Camp Craft Road	1106
Lake Creek	LKC1	Lake Creek @ Sugar Berry Cove	1098
	LKC2	Lake Creek @ Shadowbrook Club	3978
	LKC3	Lake Creek Below Meadowheath Drive	1100
Little Barton Creek	LBA1	Little Barton Creek @ Barton Creek (LBC)	77
	LBA2	Little Barton Creek @ Great Divide Dr	1114
	LBA3	Little Barton Creek @ Hamilton Pool Rd	1115
Little Bear Creek	LBR1	Little Bear Creek @ Bear Creek	1101
	LBR2	Little Bear @ Ashmun Property	3374
Little Bee Creek	LBE1	Little Bee Creek @ Red Bud Trail	1105
Onion Creek	ONI1	Onion Creek @ South Austin Regional WWTP (SAR)	1366
	ONI2	Onion Creek @ McKinney Falls Below Lower Falls	255
	ONI3	Onion Creek Above Footbridge (OC3)	241
	ONI4	Onion Creek @ Twin Creeks Road (OC1)	236
	ONI4a	*no flow, no sampling in reach*	
	ONI5	Onion Creek near Driftwood (Hwy 150)	612
	ONI6	Onion Creek at Pfulman Ranch	1365
Rattan Creek	RAT1	Rattan Creek @ Shadowbrook Circle	1097
	RAT2	Rattan Creek Above Parmer Lane	1009
Slaughter Creek	SLA1	Slaughter Creek @ Pine Valley Drive	1082
	SLA2	*no flow, no sampling in reach*	
	SLA3	Slaughter Creek @ FM 1826 (USGS)	623
South Boggy Creek	SBO1	South Boggy Creek @ Bluff Springs Road (BO1)	227
	SBO2	South Boggy Creek @ W. Dittmar Rd	1081
Taylor Slough (North)	TSN1	Taylor Slough North @ Mayfield Park	3969
Taylor Slough (South)	TSS1	Taylor Slough South @ Reed Park (TSS)	318
West Bull Creek	WBL1	West Bull Creek Above Bull Creek (EK)	343
	WBL2	West Bull Creek @ Bell Mt. Road (ED)	148

Phase III - (sites monitored in Year 2002, 2005, 2008, etc)

Watershed	Reach	Site Name	FSDB #
Cottonmouth Creek	CTM1	Cottonmouth Creek @ Dee Gabriel Collins Rd.	1206
Decker Creek	DKR1	Decker Creek @ Gilbert	1974
	DKR2	Decker Lake—NO SAMPLING	
	DKR3	Decker Creek @ Lindell Lane	1196
Dry Creek (South)	DRE1	Dry Creek (South) @ Wolf Lane	1210
	DRE2	Dry Creek (South) @ Pearce Rd.	1211
Elm	ELM1	Elm Creek @ Austin Colony	3614
	ELM2	Elm Creek @ FM 973	1204
Gilleland	GIL1	Gilleland Creek @ FM 969	886
	GIL2	Gilleland Creek @ FM 973	1192
	GIL3	Gilleland Creek @ West Parsons St.	1191
	GIL4	West Gilleland Creek @ Cameron Rd.	1194
	GIL5	Gilleland Creek @ Cameron Road	1914
	GIL6	Gilleland Creek @ South Railroad Ave.	1193
Harris	HRS1	Harris Branch Creek @ Boyce Ln.	1201
	HRS2	Harris Branch Creek @ Crystal Bend Dr.	1199
Lake Austin	LKA1	Turkey Creek @ City Park Road	1221
	LKA2	Cuernavaca Creek @ River Hills Road	1222
	LKA3	Panther Hollow Creek @ Big View Road	1223
	LKA4	Common Ford Trib. in Common Ford Metro Park	1048
	LKA5	Unnamed Trib. @ Running Deer Trail (AST)	316
	LKA6	Bear Creek (West) @ Fritz Hughes Park Rd.	1224
Marble	MAR1	Marble Creek above Onion Creek (M1)	231
	MAR2	Marble Creek @ Thaxton (M2)	232
North Fork Dry	NFD1	North Fork Dry Creek @ FM 812	1217
South Fork Dry	SFD1	South Fork Dry Creek @ FM 812	1216
	SFD2	South Fork Dry Creek @ US 183	1215
Rinard	RIN1	Rinard Creek @ Bradshaw	233
	RIN2	Rinard Creek @ FM 1327	1220
	RIN3	Rinard Creek @ FM 1327 & Bradshaw Rd.	1219

12. Describe special sample conditions. List only deviations from routine non-storm conditions as described in the SOP manual.
Biological sampling must occur during baseflow conditions. For biological sampling, there must not only be a minimum flow, but also an absence of scouring flow events, prior to sampling.

Daily mean flow from three USGS gages, available from the USGS website (http://tx.waterdata.usgs.gov/nwis/current?type=flow), are used as surrogates for flow conditions in the Austin area: Bear Creek at FM1826 (08158810), Bull Creek at Loop 360 (08154700) and Walnut Creek at Webberville Road (08158600). The 25th percentile of daily mean flow calculated over the past 20 years is used as an arbitrary indication of minimum baseflow conditions. The three gages listed above must yield daily mean flow values greater than or equal to the values presented in Table A *for at least 10 days prior to biological*

sampling in order to fully satisfy the minimum baseflow requirement. In addition, all three gages must have had continued measurable flow for 90 days prior to biological sampling events, based on observed recolonization rates.

Table A. Minimum mean daily flow required for biological sampling.

USGS Gage	Minimum Daily Mean Flow (cfs) 10 days prior to sampling
Bear Creek @ FM 1826 (08158810)	0.01
Bull Creek @ Loop 360 (08154700)	1.0
Walnut Creek @ Webberville Rd (08158600)	3.0

In addition to the minimum flow requirements, biological sampling must occur no sooner than 2 weeks after high flow scouring events, as defined in Table B. These values were determined by calculation of the 90th percentile of mean daily flow records analyzed over the past 20 years. If flow events of the magnitudes listed in Table B occur at either or all of the three gage locations, biological sampling must be postponed for at least 14 days.

Table B. Mean daily high flow values resulting in 2-week postponement of sampling.

USGS Gage	High Daily Mean Flow (cfs)
Bear Creek @ FM 1826 (08158810)	10
Bull Creek @ Loop 360 (08154700)	50
Walnut Creek @ Webberville Rd (08158600)	75

13. Describe special collection methods. List only deviations from routine sample collection methods as listed in the SOP manual.
    For phase III watersheds only, if no suitable riffle can be found for surber sampling, benthic samples will be collected for 3 man-minutes from roots, logs, plants, undercut banks and snags by RBA protocol.

14. List special laboratory analytical methods. Include details on CRP requirements, non-EPA approved methods and in-house analyses (Ohmicron).
    N/A

15. Where will the samples be analyzed?
    Benthic macroinvertebrates samples will be identified in-house. Diatom samples will be identified by Barbara Winsborough.

16. How much will samples cost?
    Diatom samples will cost $60 per sample. Four replicate samples (one per team) will be collected per year.

    The total estimated annual cost varies from $1,980 – $3,360, depending on the phase

Table 16. Cost for diatom analysis.

EII Phase	# Sites	# QC Samples	Total Cost
I	56	4	$3,360
II	49	4	$2,940
III	33	4	$1,980

17. What possible problems may arise in sample collection and what actions can be taken to mitigate their impact?
    Sites may be dry at time of sample collection. If dry, the site will not be sampled for biology but habitat assessment and non-contact recreation assessment will be completed. For NCR at dry sites, only flow, litter, and odor are to be collected.

Validation

18. What type, how often and where will QA/QC samples will be collected? Include QA/QC samples names in the FSDB if applicable.
    Each sorted pan of benthic macroinvertebrate samples will be checked for missed organisms by a different member of the field staff. The detritus from 1 out of every 10 samples will be preserved and returned to the lab for verification. Percent missed will be noted to monitor effectiveness of each field team.

    Each team will collect one field replicate diatom sample per sampling year.

19. In addition to the automated data flagging process, how will QA/QC results be used to validate data quality?
    Susan working on diatom qc limits…

20. In case of QA/QC failure, what corrective action will be taken?
    <INSERT TEXT>

Assessment

21. By what specific methods will the data be analyzed?
    Diatom and benthic macroinvertebrate components are calculated separately, then averaged equally to determine the total Aquatic Life Sub-index score for each site. Metric scores are used to determine the individual component scores as detailed below.

    Four metrics are used to determine the diatom aquatic life component: Cymbella Richness, Percent Motile Taxa, Percent Similarity to Reference Sites and Pollution Tolerance Index.

    Nine metrics are used to determine the benthic macroinvertebrate aquatic life component: Hilsenhoff Biotic Index, Number of Ephemeroptera Taxa, Number of EPT Taxa, Number of Intolerant Taxa, Number of Taxa, Percent Dominance (Top 3 Taxa), Percent of Total of Chironomidae, Percent of Total as EPT, Percent of Total as Predators. The EII scores for each of these metrics are calculated, then averaged equally by group (diatom, benthic) to yield the total component scores.

    The 5^{th} and 95^{th} percentiles for each metric are calculated and extreme values are set to either the 5^{th} or 95^{th} percentile to prevent outliers from determining the range of scores against which sites would be compared. The truncated metrics are converted to EII scores on a 100-point scale using linear interpolation between the 5^{th} (equal to 0) and 95^{th} (equal to 100) percentile values:

EII Metric Score = 100*(truncated metric – 5^{th} percentile)/(95^{th} percentile – 5^{th} percentile)

For one diatom metric (Percent Motile) and three benthic macroinvertebrate metrics (HBI, % Chironomidae, and % Dominance), lower scores imply better conditions. For these metrics, the calculated score is subtracted from 100 to determine the final metric score. The p5p95.csv files used in the calculation of the bug and diatom components of the Aquatic Life Index will be updated once every three years (following the completion of a full round of sampling—phase 1, 2 and 3). The next update will occur at the end of 2005, following completion of phase 3 watershed sampling. All preceding EII bug and diatom data will be used to calculate the updated 5^{th} and 95^{th} percentile values.

Note that the maximum reference site score is used to normalize all site scores for a given sampling year. Thus, each final metric score is divided by the maximum reference site score to yield the final metric score. All scores greater than 100 are set to 100.

The p5p95.csv files used in the calculation of the bug and diatom components of the Aquatic Life Index will be updated once every three years (following the completion of a full round of sampling—phase 1, 2 and 3). The next update will occur at the end of 2005, following completion of phase 3 watershed sampling. All EII bug and diatom data collected will be used to calculate the 5^{th} and 95^{th} percentile values.

Non-Contact Recreation
Non-Contact Recreation scores are calculated for each site as:
NCR Score = [∑ values for each scoring parameter)/(# of scoring parameters*20)]*100

Physical Integrity (Habitat Quality)
The ten parameters listed on the Habitat Quality assessment sheet are averaged equally and adjusted to a 100-point scale to calculate the physical integrity sub-index score.

The Pfankuch data is not included in the EII score.

22. What hypotheses will be tested?
    All individual component, sub-index or index scores for every site and watershed have not changed from previous scores by more than one EII category.

23. When and/or how often will the data be analyzed?
    Data will be analyzed annually in January, or as soon as all data has been received from laboratory.

24. How will it be determined that the study objectives have been met?
    <INSERT TEXT>

Reporting

25. When and what type of reports will be generated? Who will generate the report?
    Data will be included in annual State of the Environment Report.

    A major review will be conducted once every third year (2006, next report by April 2006 or as soon as all data has been entered to FSDB) by WMA representative.

    Annual data reports will be completed by Andrew Clamann.

26. Who will review the reports prior to publication?
    Mateo Scoggins, Ed Peacock, Martha Turner

References

WRE Standard Operation Procedures Manual
File:\\G:\EnvironmentalResourceManagement\WRE\!WRE_SOPs\WRE%20SOP%20Manual%202004.doc