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Technical Assessment of the Old, Mississippi, Atchafalaya, and Red (OMAR) Rivers: Channel Geometry Analysis

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Technical Assessment of the Old, Mississippi, Atchafalaya, and Red (OMAR) Rivers

Channel Geometry Analysis

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Abstract

The Old River Control Complex (ORCC) consists of the Low Sill, Auxiliary, and Overbank structures as features of the Old River Control Structure (ORCS) and the privately owned hydro-electric power plant. Operations of the ORCC manage the hydrologic connectivity between the Mississippi River and the Atchafalaya River/Red River systems.

The morphology of the Old, the Mississippi, the Atchafalaya, and the Red Rivers (OMAR) has been influenced by the flow distribution at the ORCC, as well as the accompanying bed sediments. A geomorphic assessment of the OMAR is underway to understand the morphological changes associated with operation of the ORCC. Supporting the geomorphic assessment, a channel geometry analysis herein documents observed adjustments of the affected river channels. Historical hydrographic survey data were used in the Geographic Information System to create river channel geometric models, which inform the analysis.

Geometric parameters for cross sections and volume polygons were computed for each survey and evaluated for morphological trends which may be ascribed to the influence of the ORCC. Additionally, the geometric parameters for the Atchafalaya River were used to extend the geometry analyses from the 1951 Mississippi River Commission report on the Atchafalaya River, which was the primary catalyst for the initial development of the ORCS.

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Preface

The investigation documented in this report was conducted for the US Army Corps of Engineers, Mississippi Valley Division (MVD), as part of the Mississippi River and Tributaries Project, under Project No. 478534 and published through the Mississippi River Geomorphology and Potamology (MRG&P) Program. At the time of publication of this report, the MRG&P Program director was Dr. James W. Lewis. The MVD commander was MG Diana M. Holland, and the MVD director of programs was Mr. Edward E. Belk.

Contributions to this effort were provided by the River and Estuarine Engineering Branch (REEB) of the Flood and Storm Protection Division, US Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory (ERDC-CHL). At the time of publication of this report, Mr. David P. May was chief of the REEB and Dr. Cary A. Talbot was chief of the Flood and Storm Protection Division. The deputy director of ERDC-CHL was Mr. Keith Flowers, and Dr. Ty V. Wamsley was the director.

The commander of ERDC was COL Christian Patterson, and the director was Dr. David W. Pittman.

1 Introduction

1.1 Background

The Old River Control Complex (ORCC) is located in the Mississippi River alluvial plain in Avoyelles Parish, Louisiana, adjacent to Wilkinson County, Mississippi. The area is historically where the Red River was a tributary and the Atchafalaya River was a distributary to the Mississippi River in a meander loop of the river known as Turnbull Bend. In 1831, Capt. Henry Shreve constructed a cut-off channel across the neck of Turnbull Bend, resulting in the formation of a connecting channel that became known as Old River. The channel acted as the hydrologic connection between the Mississippi River and Red River/Atchafalaya River systems, with flow exchange possible in both directions between the river systems. With the subsequent clearing of massive log jams in the area, a larger percentage of the Mississippi River discharge was carried through Old River into the Atchafalaya River. As a result, the Atchafalaya River channel began to enlarge. Over time, there grew a concern that the increase in capacity of the Atchafalaya River might eventually lead to the capture of the Mississippi River through the much shorter route to the Gulf of Mexico provided through the Atchafalaya River. A 1951 Mississippi River Commission report recommended the diversion of flow at Old River should be controlled by a complex of structures, and in 1954, the US Congress authorized the Old River Control Project.

The first structures of the Old River Control Project to be constructed were the low sill flow control structure and the overbank structure, which were completed in 1959. These structures were located in the vicinity of the upper portion of the abandoned Turnbull Bend meander loop, with the low sill structure intended to regulate discharge during normal conditions and the overbank structure to operate during major flood events. A navigation lock was constructed in 1963 in the Lower Old River channel to maintain shallow draft navigation between the river systems. Subsequent to the completion of the low sill and overbank structures, the Old River Control Structure (ORCS) has been regulated to maintain a 70/30 percentage distribution of the total annual latitude discharge at the complex between the Mississippi River and Atchafalaya River, respectively. The 70/30 percentage distribution approximates the average

flow distribution that existed at the time of the 1951 report. Since the addition of the auxiliary flow control structure in 1986, as a feature of ORCS, and the privately owned hydro-electric power plant in 1990, (collectively referenced as the ORCC), the target regulated discharge distribution is accomplished through combinations of the individual structure releases.

The recent morphology of the area river systems has been influenced by the discharge regulation at the ORCC, as well as the accompanying transport of bed material sediments through the structures. Over the 6 decades since commencement of ORCS operation, the Mississippi River and Atchafalaya River have undergone adjustment through both channel aggradation and incision, respectively. These changes represent the complex morphologic response of the systems not only to the impacts of the ORCC but also the continuing impact of the Mississippi River meander cut-off program and the Red River navigation project on sediment loads in the systems. Channel aggradation on the Mississippi River may be associated with numerous factors including rising flowlines on Mississippi River, ORCC structure stability and operation limitations, and hydropower operation.

Inability to manage both flow and sediment could have impacts to both the Mississippi River and Atchafalaya River systems, as well as increasing risk for the people of South Louisiana. In addition, the Atchafalaya, Lower Red, and Black Rivers are reported to be experiencing bank instability issues. As a consequence of these complex and interrelated processes, the Mississippi Valley Division initiated a program of assessment entitled the *Old River, Mississippi River, Atchafalaya River, and Red River (OMAR) System Technical Assessment*.

A geomorphic assessment of the OMAR is underway to identify and understand the spatial and temporal morphological changes associated with operation on the ORCC. This geomorphic assessment includes the development of a timeline and analysis of specific gage records, stage duration curves, river slope, channel geometry trends, bed material data, and other analyses. The purpose is to identify cause-effect and process-response relationships that result in short- and long-term changes in the hydrology, hydraulics, and morphology of this river system. A channel geometry analysis is reported herein that documents observed adjustments in the channel dimensions of the affected river channels.

Historical hydrographic survey data were used in Geographic Information System (GIS) to create river channel geometric models, which inform the analysis. Geometric parameters were computed for each survey period and evaluated for morphological trends which may be ascribed to the influence of the ORCC. Additionally, the geometric parameters for the Atchafalaya River were used to extend the channel geometry analyses from the 1951 Mississippi River Commission (MRC) report on the Atchafalaya River, which was the primary catalyst for the initial development of the ORCS.

Construction and operation of the ORCC has influenced the morphology of the Mississippi River and Atchafalaya River system in the Lower Mississippi River alluvial valley. However, it is just one of several factors whose integrated effects have sculpted the overall riverine landscape in the lower valley. The Mississippi River & Tributaries (MR&T) Project, authorized by the Flood Control Act of 1928, was developed to provide flood control and reliable navigation on the Lower Mississippi River. The MR&T Project achieves project goals through a system of levees, channel improvements, floodways, and tributary improvements. Meander bend cutoffs performed during the 1930s and early 1940s as part of the channel improvement objective had a notable impact on the vertical stability of the river through channel incision and increased sediment delivery.

Revetments constructed to stabilize eroding channel banks have limited the meander tendency of the river, resulting in a more stable channel pattern than has historically existed and reduced sediment supply. Additionally, channel improvements on the Red River as part of the Red River Navigation Project have affected available sediment that is delivered to the vicinity of the ORCC and the Atchafalaya River. All these influences must be considered in assessing the overall morphology of the river systems in the ORCC area.

Previous studies conducted on the Lower Mississippi River that included a geomorphic assessment have taken a similar approach to investigate the temporal and spatial changes in the Lower Mississippi River valley. Little and Biedenharn conducted a geomorphic assessment of the Lower Mississippi River from ORCC to Head of Passes as part of the joint agency Mississippi River Hydrodynamic and Delta Management Study (Little and Biedenharn 2014). As part of the USACE Mississippi Valley Division, Mississippi River Geomorphology & Potamology Program, Heath et al. (2015) conducted a sedimentation investigation of the ORCC that included

field data collection and laboratory analysis, geomorphic assessment, and numerical model analysis (Heath et al. 2015). The objectives of the study were to determine current rates of sediment diversion, evaluate potential impacts on the stability of the Mississippi River, and identify options to increase sediment diversion rates. An analysis of channel geometry trends of the Mississippi River from the ORCC to St. Louis, MO, was conducted as part of a detailed geomorphic assessment in the MRG&P program (Little et al. 2017). The purpose of the study was to document long-term trends in the dimension, pattern, and profile of the Mississippi River channel within the study reach.

1.2 Objectives

The objective of this assessment was to conduct a geometric analysis of hydrographic surveys along the Mississippi River, Atchafalaya River, and Old River. This analysis includes comparisons of comprehensive and periodic hydrographic surveys to inform the morphologic changes that have occurred along these rivers systems over the past 6 to 7 decades. This analysis was just one of several components of the overall geomorphic assessment being conducted for the OMAR Project.

This effort is a part of the overall Old, Mississippi, Atchafalaya, and Red Rivers Assessment. Table 1 lists the series of reports associated with the overall project, with this report listed in bold font.

Table 1. List of reports included in the overall project.

Volume	Report Name	Description
1	Main Report	Summarizes the entire project assessment
2	Geomorphic Assessment	Analyzes the historic trends in hydrology, sedimentation, and channel geometry of the river reaches of interest
3	Channel Geometry Analysis	Analyzes the hydrographic surveys over the past 6 to 7 decades
4	Mississippi River HEC-6T Model	Evaluate the long-term and system-wide sedimentation effects on the Mississippi River
5	Atchafalaya River HEC-6T Model	Evaluate the long-term and system-wide sedimentation effects on the Old, Atchafalaya, and Red Rivers
6	Mississippi River Multi-Dimensional Model	Evaluate the short-term effects on the Mississippi River

Table 1. (cont.) List of reports included in the overall project.

Volume	Report Name	Description
7	Red and Atchafalaya Rivers AdH Model	Evaluate the short-term effects on the Old, Atchafalaya, and Red rivers
8	HEC-RAS Model	Investigate how water is stored in the Lower Red River floodplain
9	HEC-RAS BSTEM Analysis of the Atchafalaya River	Compare the relative impact of various scenarios on bank retreat in the upper portion of the Atchafalaya River

1.3 Assessment area

The river reaches of the OMAR area for this assessment are shown in Figure 1. In general, the assessment reach on the Mississippi River extends from Vicksburg, MS, to Baton Rouge, LA. The assessment reach for the Atchafalaya River extends from the confluence with Old River to the Highway 90 Bridge at Morgan City, LA. For the Red River, the assessment reach extends from the John H. Overton Lock and Dam just downstream from Alexandria, LA, to the confluence with Old River. The Red River was not studied as part of this particular report due to a lack of hydrographic surveys in a digital format; analysis of the geometry of the Red River is planned for a future effort. For Old River, all of inflow and outflow channels of the structures in the ORCC are included in the assessment area. The relict channel of Turnbull Bend where the Old River Lock is located is not included as part of the assessment area.

Figure 1. OMAR geometry analysis assessment area.



1.4 Approach

The analysis documented in this report used available historical hydrographic surveys to evaluate the cross-section and volumetric properties of each river reach. Lists of available surveys along with the methods used to process that data are described further in Section 2.

2 Approach

Historical hydrographic survey data of the Lower Mississippi River (inclusive of Old River) and the Atchafalaya River were collected from the US Army Corps of Engineers (USACE) Vicksburg and New Orleans Districts. The formats of the available survey data included hard copy maps, XYZ point files, computer-aided design and drafting drawings, and GIS surfaces from previous studies. All survey data were imported into GIS, and geometry models were developed for each survey. The geometry models included triangulated irregular network (TIN) surfaces and then digital elevation model raster files for certain GIS processing. After creating the TIN surfaces, the surfaces were analyzed for interpolations from poor triangulation. Poor triangulation was then removed by adding breaklines and swapping edges to achieve representative coverage. This was then compared to existing physical maps as available to check for remaining artifacts. In the older data sets, the surface creation process included the correction of incorrectly entered elevations (identified as unrealistically sharp changes limited to a single point). Cross sections were created in an ArcGIS shapefile at 1 mi^{††} intervals for the Mississippi River, Atchafalaya River, and at selected locations for Old River. The cross sections capture the entire channel perimeter and a short portion of the adjacent flood plain but do not extend across the entire flood plain. For cross sections, particularly bars, data were allowed to extend beyond the cross section if the terrain was thought to be similar. The bathymetric data for each survey surface were extracted at these points. The bathymetric data for each survey period were extracted along these cross sections and imported into spreadsheets for computation of geometric parameters. Channel cross-sectional area, width, hydraulic depth, computed conveyance, and width/depth (W/D) ratio were computed for each section referenced to the low water and bankfull reference planes for each river. Additionally, shapefiles were used to create polygons to encompass the river channel in 1 mi segments. Channel volumes referenced to the low water and bankfull plane were computed for these 1 mi segments and used

* For a full list of the spelled-out forms of the units of measure used in this document, please refer to *US Government Publishing Office Style Manual*, 31st ed. (Washington, DC: US Government Publishing Office 2016), 248-52, <https://www.govinfo.gov/content/pkg/GPO-STYLEMANUAL-2016/pdf/GPO-STYLEMANUAL-2016.pdf>.

† For a full list of the unit conversions used in this document, please refer to *US Government Publishing Office Style Manual*, 31st ed. (Washington, DC: US Government Publishing Office 2016), 345-7, <https://www.govinfo.gov/content/pkg/GPO-STYLEMANUAL-2016/pdf/GPO-STYLEMANUAL-2016.pdf>.

in the volumetric analysis. The polygon was limited to common extents for all surveys, for like comparison.

The cross-section and volume data were grouped along defined geomorphic reaches for analysis. Since there is considerable variation in the singular geometric parameters from cross section to cross section, determination of trends is often difficult to ascertain. To determine trends in channel dimension more clearly, the data for each reach for each survey period are statistically presented using box plots to illustrate trends in the central tendencies of the data for each geomorphic reach. The box plots display the minimum, maximum, median, and interquartile range (IQR) for each data set, as well as data outliers. In addition, the IQR and median value of each survey period were plotted to visualize trends in the central data for each reach.

This geometric analysis is part of the OMAR geomorphic assessment and presented as an appendix to the geomorphic assessment report.

The hydrographic surveys used in the assessment are, in general, comprehensive channel surveys collected by the New Orleans and Vicksburg Districts on a decadal timescale. The surveys were not always collected in the same year by both districts but were typically within 1 to 2 yr of the same date. The survey data are oriented along transects on approximately 1,000–1,200 ft spacing for the Mississippi River and Atchafalaya River. The hydrographic surveys used in the assessment are shown in Table 2.

Table 2. Hydrographic surveys used in assessment.

River	Survey Year
Mississippi River	1915, 1948, 1963–1964, 1974–1975, 1983–1988, 1992–1994, 2003–2004, 2013
Atchafalaya River	1976, 1989, 1998, 2010, 2019
Old River	1963–1964, 1974–1975, 1988–1989, 2003–2004, 2013

In general, the survey data sets have complete coverage of the rivers within the assessment area; however, there were short reaches of missing data for some years. Note that the spatial coverage of the survey data is a function of the water level at the time of data acquisition and varies from survey to survey. The bathymetric models created from each survey generally do not extend beyond the coverage of the survey data.

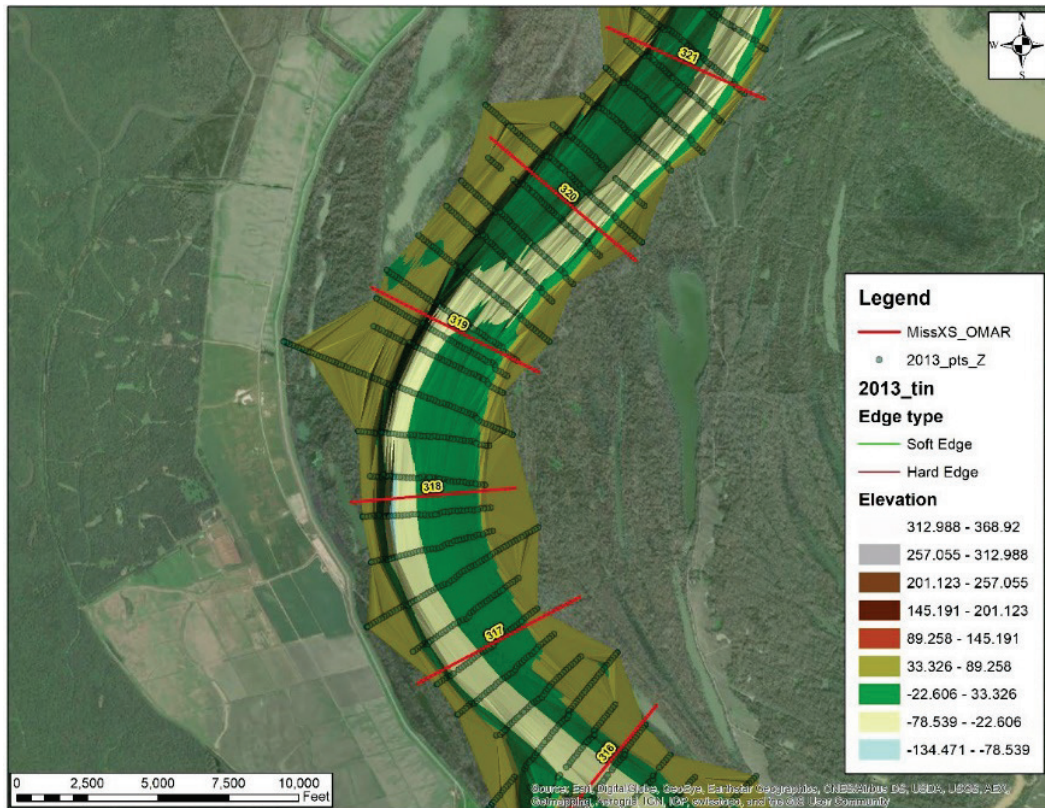
2.1 Cross-section data

Cross sections that traverse the channel from top bank to top bank were created in GIS shapefiles in 1 mi intervals for each river, with the exception of Old River where cross sections were created at selected locations. The cross sections generally extend slightly beyond each top bank to ensure the varying extents of survey data were fully captured. The cross sections were located as perpendicular to the channel path as possible using a similar methodology as used in development of one-dimensional hydraulic models such as HEC-RAS. In general, the locations of the cross section were sufficient for all survey periods except 1948 and 1915 on the Mississippi River. These 1915 and 1948 surveys predate the majority of the MR&T revetment construction, and the channel pattern was in a different location in some reaches. The 1915 survey on the Mississippi River predates all the meander bend cutoffs accomplished in the MR&T project, and as a result the river channel may be in a completely different location. For these cases, the cross-section shapefiles were spatially adjusted to capture the location of the river channel.

Station points were constructed along each cross section using GIS tools. The stations points were created at 50 ft spacing for the Mississippi River, Atchafalaya River, and Old River. The bathymetric data from each survey surface were extracted at these station points and imported into spreadsheets for computation of geometric parameters. Computations of geometric parameters at each cross section were made for cross-sectional area, width, hydraulic depth ($\text{area} \div \text{width}$), computed conveyance ($\text{area} \times (\text{hydraulic depth})^{2/3}$) and width/depth ratio ($\text{width}^2 \div \text{area}$). The geometric parameters were referenced to a low water and bankfull plane for each river. For the Mississippi River and Old River, the low water reference plane was the 2007 Low Water Reference Plane (LWRP) as defined by the New Orleans and Vicksburg Districts. The bankfull reference was assumed as the 2007 LWRP plus 25 ft, which approximates the top bank elevation. This may not be a good assumption for all locations within the assessment reach but was selected so that the elevation falls within the upper limits of all of surveys. The 1988 survey on the Mississippi River was taken during a low water period, and thus bankfull results are not shown for it. For the Atchafalaya River, the low water and bankfull reference planes were the same as used in the USACE 1951 Atchafalaya River report (US Army Corps of Engineers 1951) to document geometric properties of the Atchafalaya River channel. An example of the cross

section locations is shown in Figure 2, along with an example of typical survey data points and accompanying Triangulated Irregular Network (.TIN) geometric model.

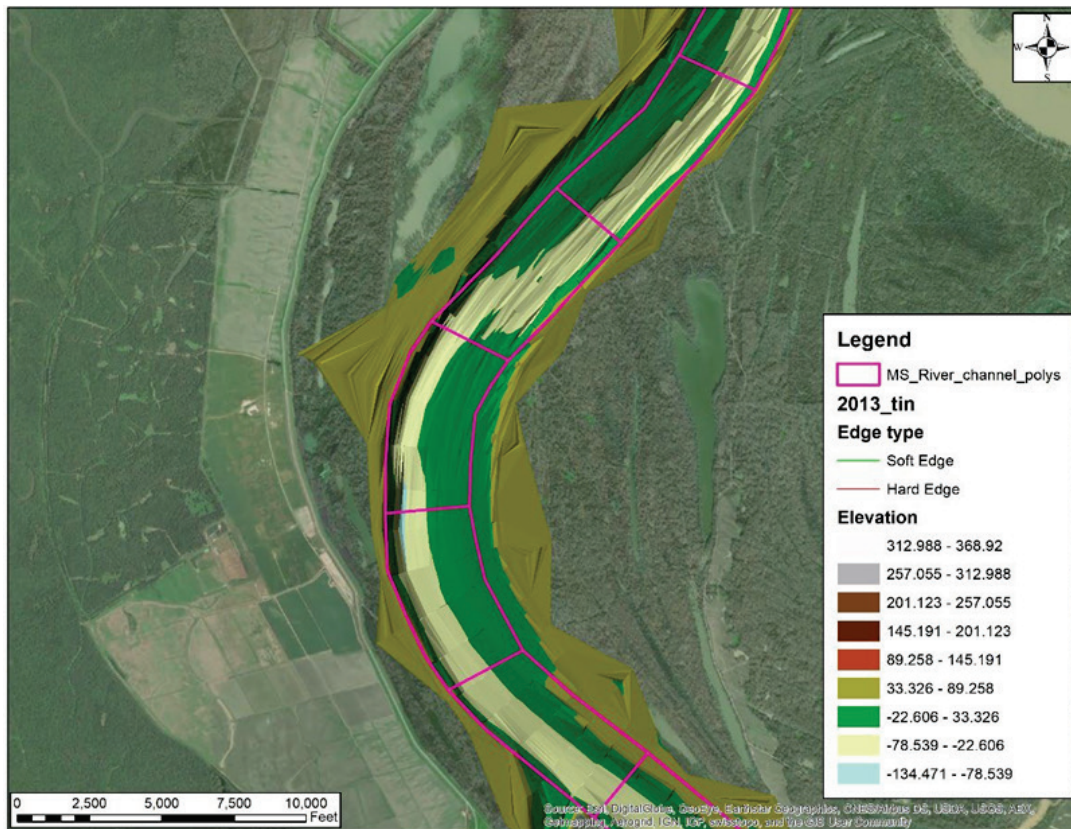
Figure 2. Example of cross-section locations with survey data and TIN surface.



2.2 Volumetric data

Polygon shapefiles were created in GIS that encompass 1 mi segments of the river channels. GIS tools were used to compute the volume of each polygon between the low water and bankfull reference planes and the geometric model surface for each hydrographic survey. The volumetric change from survey to survey represents the net erosion or deposition that occurs within the 1 mi channel segment for the time period between the surveys. An example of the volume polygons is shown in Figure 3.

Figure 3. Example of volume polygons.



The rivers in the assessment area were delineated into geomorphic reaches that represent similar hydraulic/fluvial characteristics. The geomorphic reach limits were generally based on the location of tributary confluences, gage stations, or locations of clear change in morphological characteristics. The cross-section and volume data for each river were grouped along these defined geomorphic reaches for analysis and presentation of results. The reaches associated with Old River were based on the inlet and outlet channels of the ORCC structures and are much shorter than geomorphic reaches of the other rivers in the OMAR assessment. General descriptions of the geomorphic reaches for each river are presented in Table 3; maps showing the reaches are presented in Figure 4 to Figure 6.

Table 3. Description of geomorphic reaches.

Reach	Limits (river mile [RM])	General Description
Mississippi River		
Reach 1	RM 230–314	Baton Rouge to ORCC low sill structure inlet
Reach 2	RM 314–363	ORCC low sill structure inlet to Natchez, MS
Reach 3	RM 363–435	Natchez, MS to Vicksburg, MS
Atchafalaya River		
Reach 1	RM 0–56	Old River to head of Whiskey Bay Pilot Channel (WBPC)
Reach 2	RM 56–101	Head of WBPC to Grand Lake
Reach 3	RM 101–121	Grand Lake to Morgan City, LA
Old River		
Reach 1	-----	Mississippi River to hydropower plant
Reach 2	-----	Hydropower power plant to outflow channel
Reach 3	-----	Mississippi River to low sill structure
Reach 4	-----	Low sill structure to auxiliary structure channel
Reach 5	-----	Mississippi River to auxiliary structure
Reach 6	-----	Auxiliary structure to outflow channel
Reach 7	-----	Auxiliary outflow channel to hydropower plant channel
Reach 8	-----	Power plant outflow to Red River
Reach 9	-----	Entire outflow channel, low sill structure to Red River

Figure 4. Geometric analysis reaches—Mississippi River.

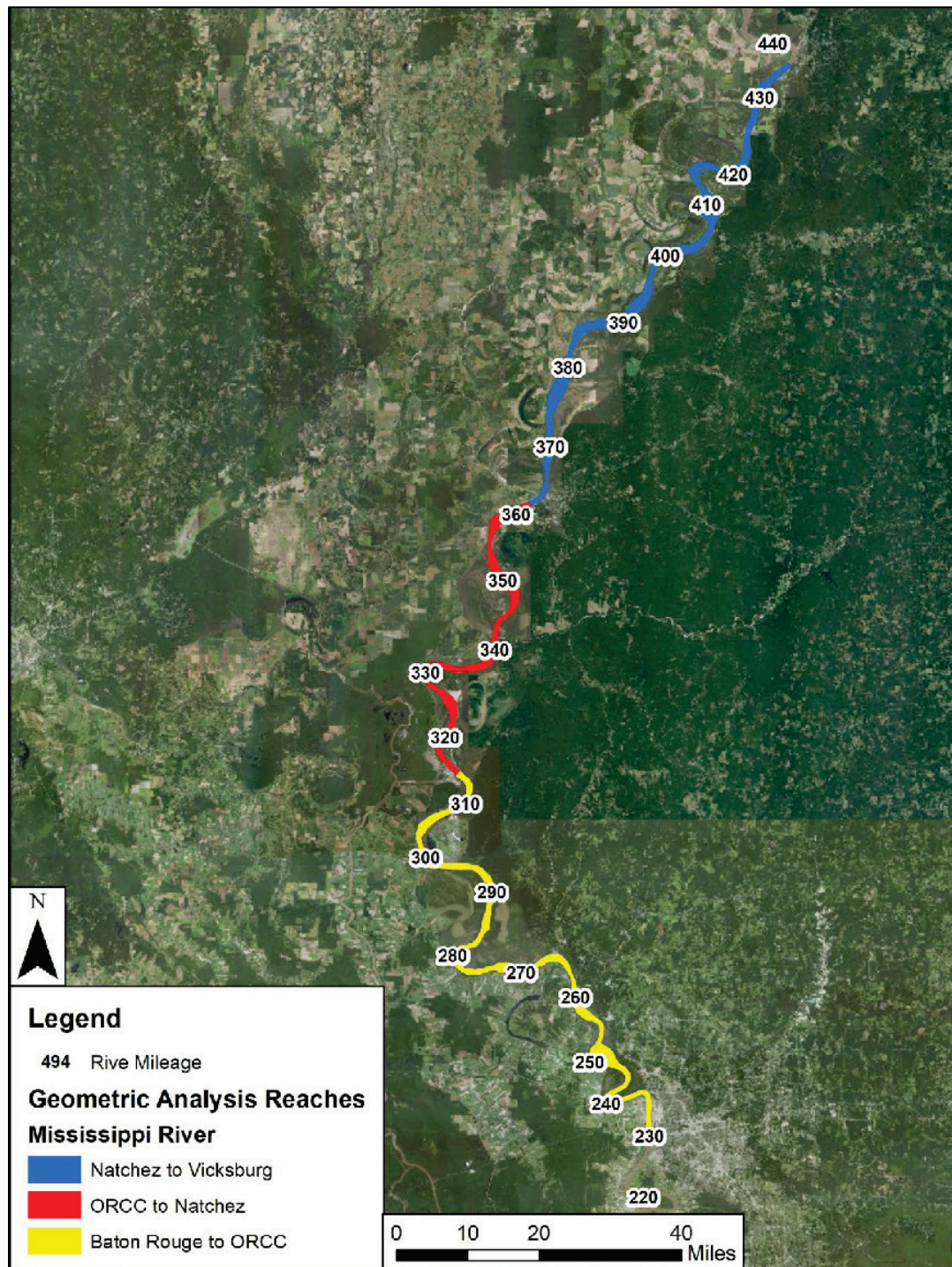


Figure 5. Geometric analysis reaches–Atchafalaya River.

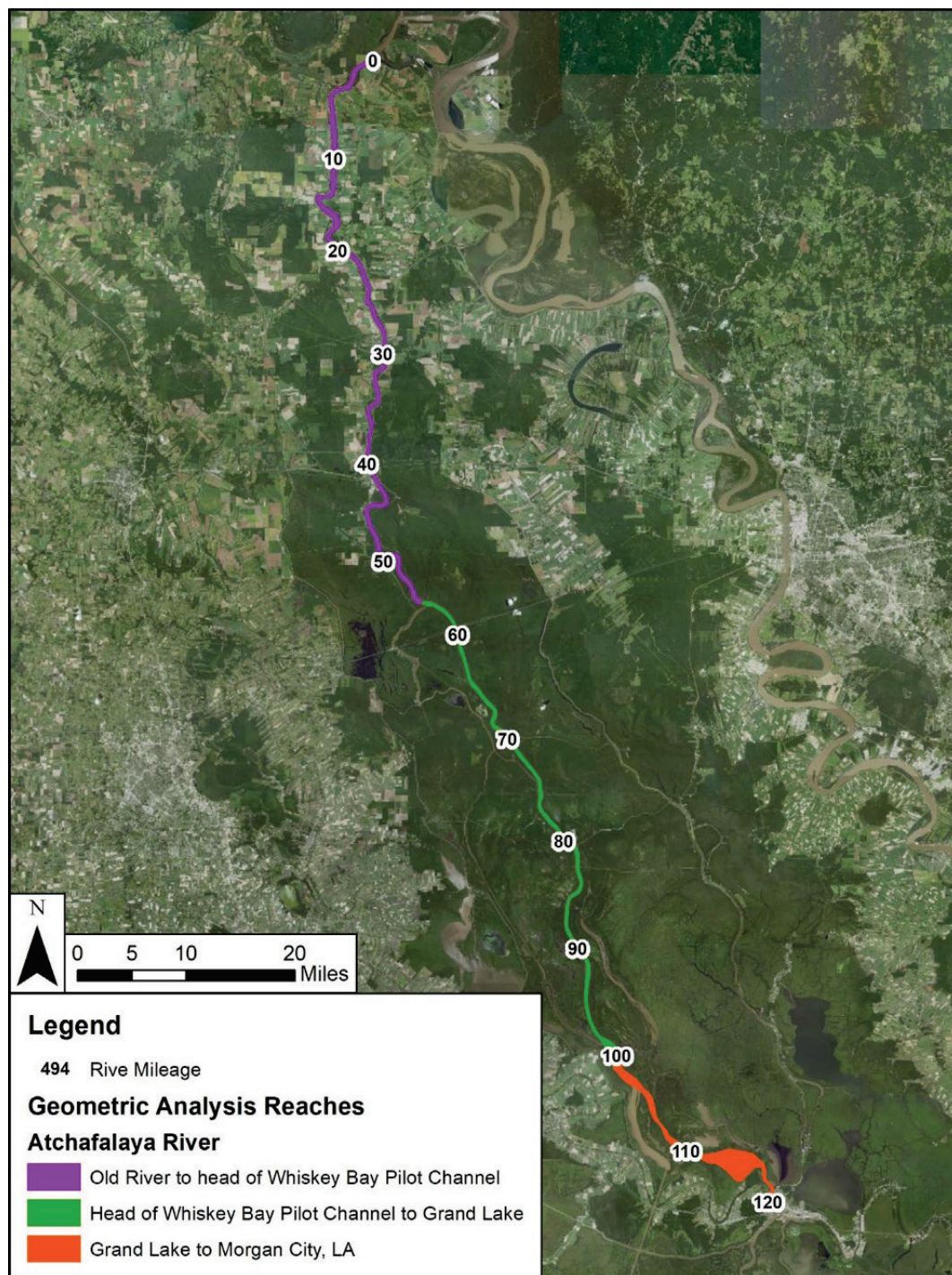
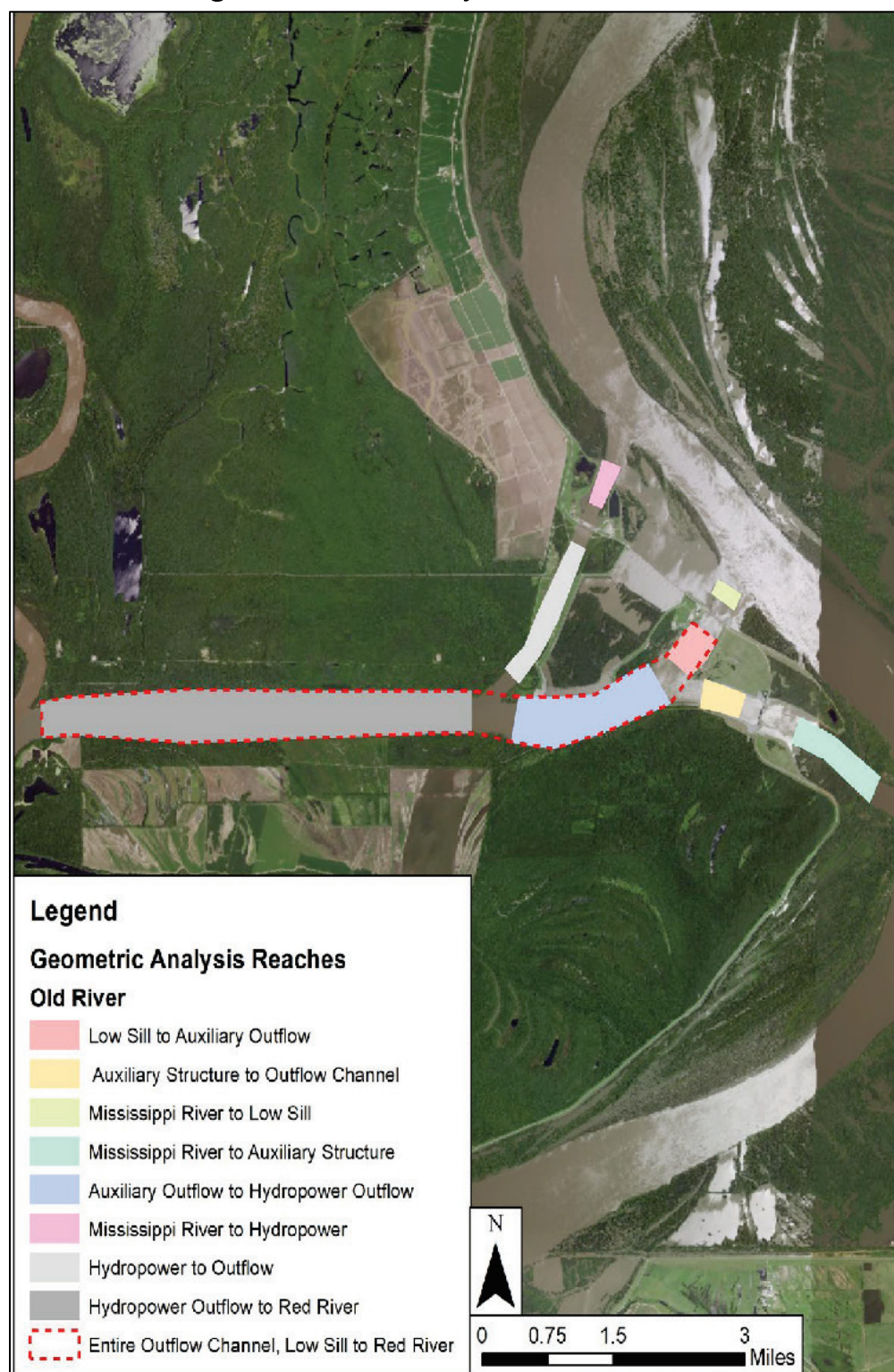


Figure 6. Geometric analysis reaches–Old River.



3 Analyses Results

The computed geometric parameters and volumes for the cross sections and channel polygons were grouped according to the geomorphic reaches for each river in the assessment area. A statistical analysis was performed for the computed data sets by calculating the minimum, 25th percentile (lower quartile), median, 75th percentile (upper quartile), and maximum values for each reach and plotting the results with box-and-whisker plots. These computed values comprise what is commonly referred to as the *five number summary*. Box-and-whisker plots illustrate the spread and central tendencies of a data set. Changes in the geometric parameters and polygon volumes illustrated by the box-and-whisker plots for each survey period can indicate trends in morphological adjustment of the river channels over time.

Note that the computed geometric parameters and volumes are subject to inaccuracies due to the varying spatial extents and quality of survey data and resulting geometry models. The data were sufficient for qualitative analyses to determine general trends or change on a reach scale. However, any quantitative analyses should be approached with caution.

3.1 Geometric parameter analyses–Mississippi River

A comprehensive tabulation of the cross-section area, width, hydraulic depth, computed conveyance, and W/D ratio for all individual cross sections of the Mississippi River geomorphic reaches is presented in Appendix A. The statistical analysis results and box-and-whisker plots for each geometric parameter for the Mississippi River are presented in the following sections.

3.1.1 Cross-sectional area–Mississippi River

Box-and-whisker plots of the computed cross-section area referenced to the LWRP for the Mississippi River geomorphic reaches are shown in Figures 7 through 9. Figure 7 indicates the trend in the median value of cross-sectional area generally decreases steadily from 1915 to 1975, remains fairly stable from 1975 to 1994, and slightly decreases from 1994 to 2013 for the Baton Rouge-to-ORCC geomorphic reach. A decrease or increase in cross-sectional area can be indicative of sediment deposition or erosion in a reach, respectively. Stable or little change in cross-sectional area can indicate a state of dynamic equilibrium in a reach or counteracting geometric changes.

Based on observations of the change in cross-sectional area, this reach of the Mississippi River appears to have experienced channel deposition during the general time period 1915 to 1975, dynamic equilibrium during 1975 to 1994, and slight deposition during 1994 to 2013 (Figure 7).

Figure 8 illustrates somewhat similar trends for the Mississippi River reach from ORCC to Natchez as those observed for the Baton Rouge to ORCC reach. The general time period 1915 to 1963 indicated a decrease in cross-sectional area, or channel deposition. There is a sharp increase in area from 1963 to 1975, then a general decrease in cross-sectional area from 1975 to 2013 (with 1975 potentially reflecting the after-effects of the historic 1973 flood). As shown in Figure 9, the observed trends for the Natchez-to-Vicksburg reach differ slightly from the first two reaches farther downstream.

Although there is slight variation in the median value of cross-sectional area, the overall trend for the general time period 1915 to 2013 is dynamic equilibrium. Within this general time period, there is a minor trend of increase in area (erosion) observed between 1948 and 1975, and a decrease in area (deposition) observed between 1975 and 1994. These observations suggest that the reach has experienced overall dynamic equilibrium for the general time period 1915 to 2013, although there were short periods of minor adjustment accomplished through erosion and deposition.

Note that cross-sectional area change can be a function of width adjustment without the presence of reach-scale channel aggradation or degradation. An example of such width adjustment would be associated with the construction of dikes to provide a dependable navigation channel. The cross-sectional area will be reduced from the construction of a dike, but the area would be expected to rebound as the channel adapts to the increased constriction. Also note that local and reach-scale adjustment of the channel geometry can occur on short temporal scales as a result of large magnitude floods or increased frequency of major floods. Observations of channel geometry change as indicated by all geometric parameters and volume computations must be assessed in consideration of other geomorphic analyses results to confidently determine overall geomorphic trends for the reaches.

Figure 7. Mississippi River Baton Rouge to ORCC, cross-sectional area at low water reference.

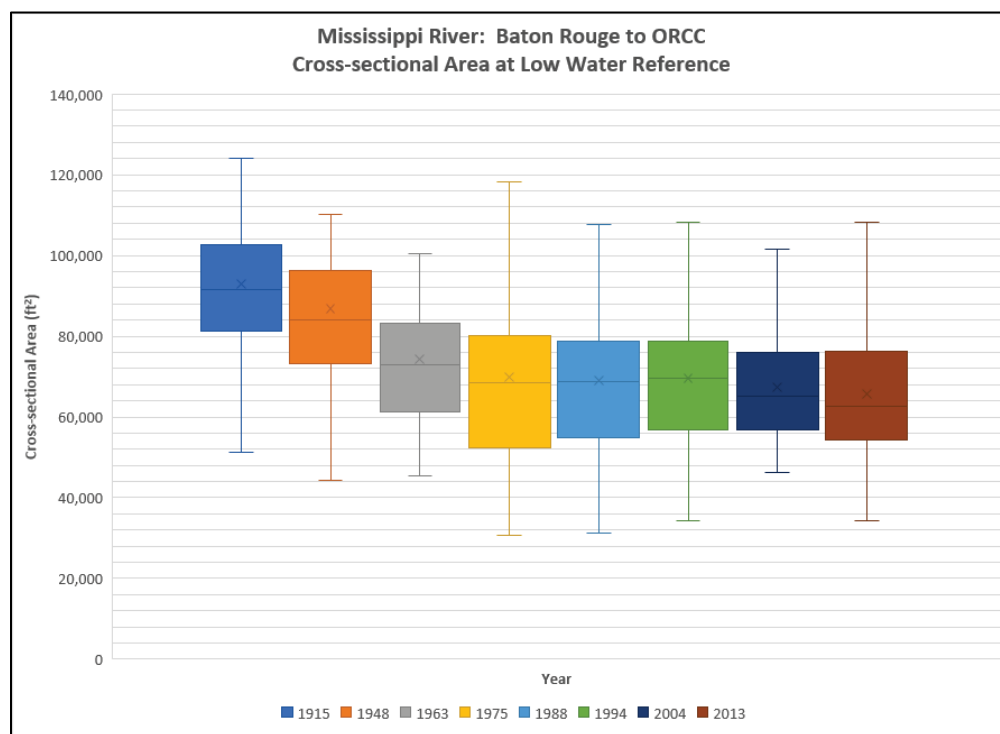


Figure 8. Mississippi River ORCC to Natchez, cross-sectional area at low water reference.

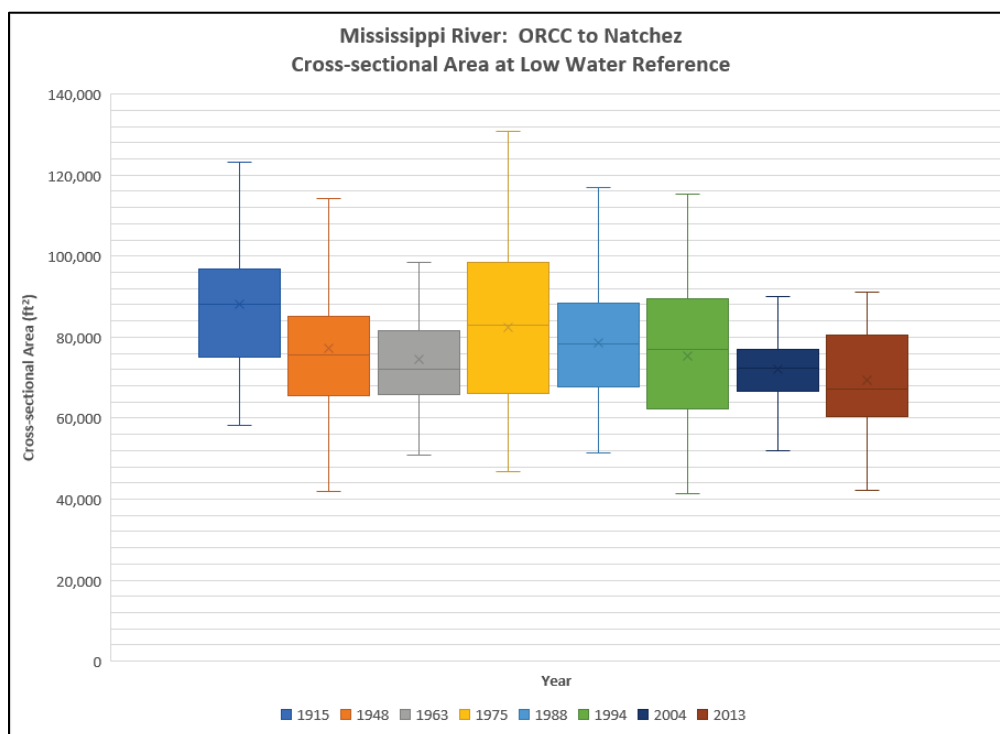
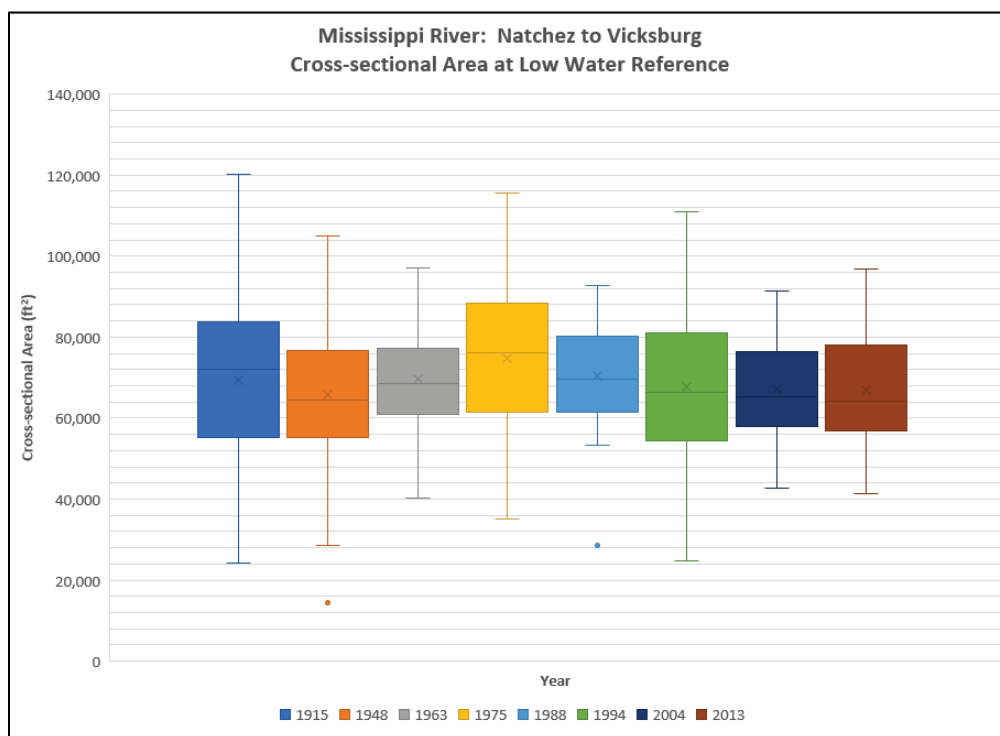


Figure 9. Mississippi River Natchez to Vicksburg, cross-sectional area at low water reference.



Another means of visualizing trends in the geometry parameters is to plot the median value and the IQR for each survey time period as continuous values from survey to survey. The IQR is plotted as a band to visualize trends in the central tendency of the data, and the median value is plotted singularly within this band. This type of plot easily illustrates the trends in the values from survey to survey. Although the plot is constructed as a Cartesian system, the abscissa is not based on equal divisions and provides no information on rates of change for plotted parameters. For purposes of this report, this type of plot is referred to as a *trend plot*.

The trend plots of cross-sectional area at low water reference for the Mississippi River geomorphic reaches are shown in Figures 10 through 12. Obviously, the trends are similar to those discussed for the box-and-whisker plots since the data are the same. However, the trend plots allow for easier visual interpretation of trends. A notable trend observed is that all three reaches experienced a reduction in cross-sectional area (deposition) from 1915 to approximately 1963, and at that point the Baton Rouge to ORCC reach entered dynamic equilibrium, whereas the ORCC to Natchez and Natchez to Vicksburg reaches showed a marked increase in area (erosion) around 1975 before beginning a slow trend on area reduction

(deposition). Although the exact cause of this response is uncertain, the 1973 and 1975 major floods in the Lower Mississippi River valley were possible contributors. These two major floods were experienced within a three-year time period which followed a 15- to 20- year period of below normal discharges. Another possibility for the observed response is the initial adjustment of the river to operations at the ORCC.

Although the observed trends are very slight, all three geomorphic reaches have indicated a continual decrease in cross-sectional area (deposition) from 1994 to the most recent survey period. This trend suggests that the Lower Mississippi River encompassed by the three reaches is undergoing a response of slow, system-wide aggradation.

Figure 10. Mississippi River Baton Rouge to ORCC, trend plot of cross-sectional area at low water reference.

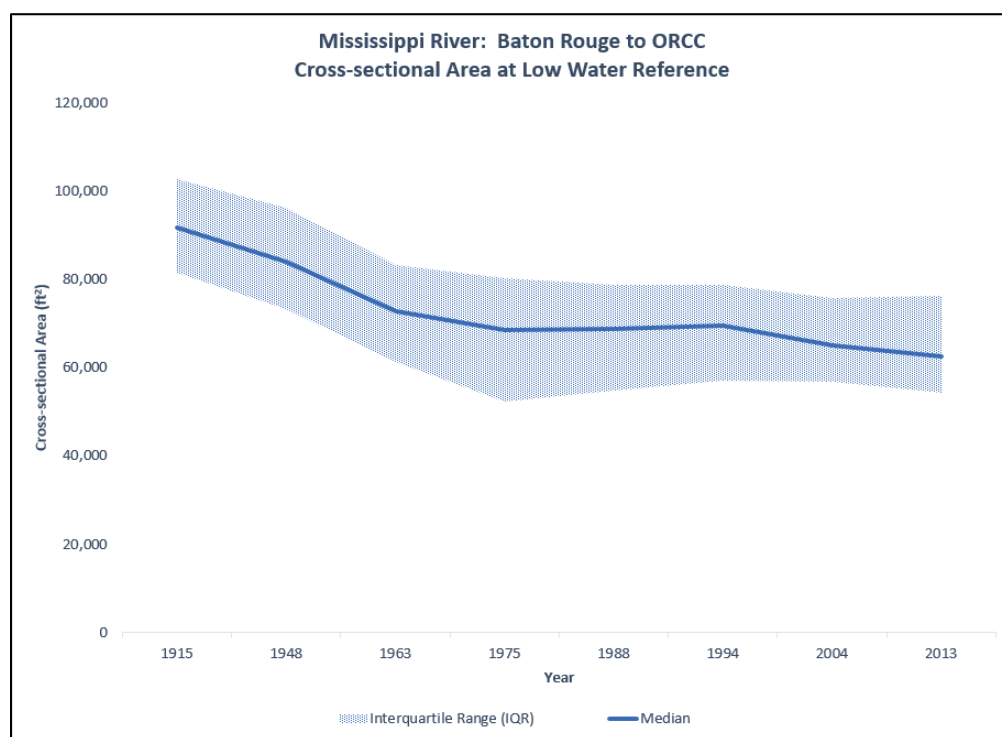


Figure 11. Mississippi River ORCC to Natchez, trend plot of cross-sectional area at low water reference.

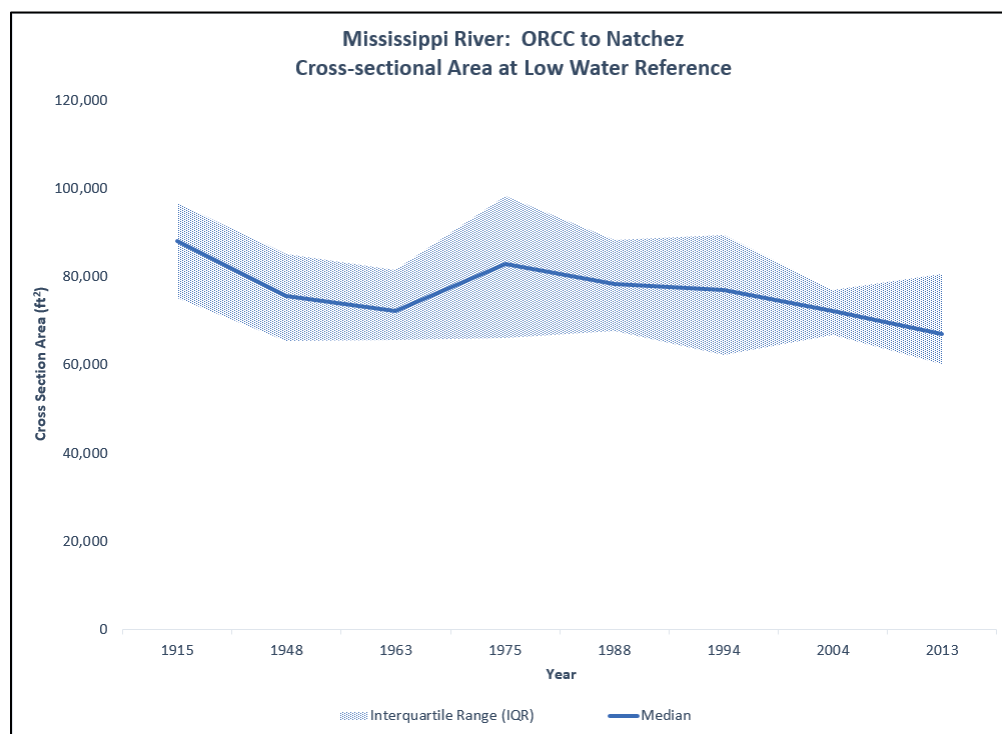
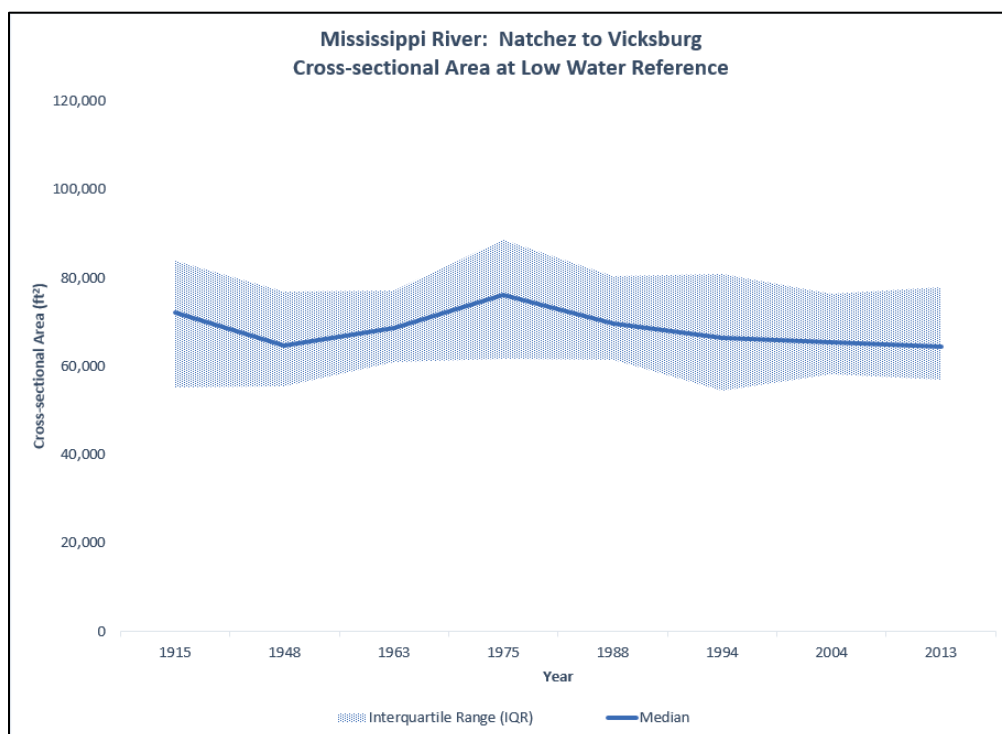


Figure 12. Mississippi River Natchez to Vicksburg, trend plot of cross-sectional area at low water reference.



Box-and-whisker plots of the computed cross-section area referenced to bankfull reference plane for the Mississippi River geomorphic reaches are shown in Figures 13 through 15. In Figure 13, the box-and-whisker plot for the Baton Rouge-to-ORCC reach indicates little change from 1915 to 1948, then a trend of decreasing cross-sectional area (deposition) from 1948 to 2013. The general trend patterns in cross-sectional area for the bankfull and LWRP are, however, very similar.

Figure 14 indicates the general trend pattern for cross-sectional area for the ORCC-to-Natchez reach is very similar to that for the low water reference. However, there is a marked difference in trend pattern of cross-sectional area referenced to bankfull for the Natchez-to-Vicksburg reach, as shown in Figure 15. Instead of a decreasing trend in area as seen for cross-sectional area referenced to low water, the area referenced to bankfull indicates an increasing trend (erosion) in area from 1915 to 1963. After 1963, the trends between the reference plains are fairly similar. The difference in trends for the 1915 to 1963 period is puzzling. From a river response standpoint, the increase in area for the bankfull reference could be possibly explained as a response to the MR&T meander bend cut-off program executed in the 1930s and early 1940s. There were a couple of cutoffs constructed in this reach, and the channel erosion that occurred in response to the cutoffs would have resulted in increased cross-sectional area. However, it is not reasonable that this trend would be reflected only in the bankfull referenced data and not in the low water referenced data. The probable cause for this observed difference is unknown.

The trend plots for cross-sectional area referenced to bankfull for the three Mississippi River geomorphic reaches are presented in Figures 16 through 18.

Figure 13. Mississippi River Baton Rouge to ORCC, cross-sectional area at bankfull reference.

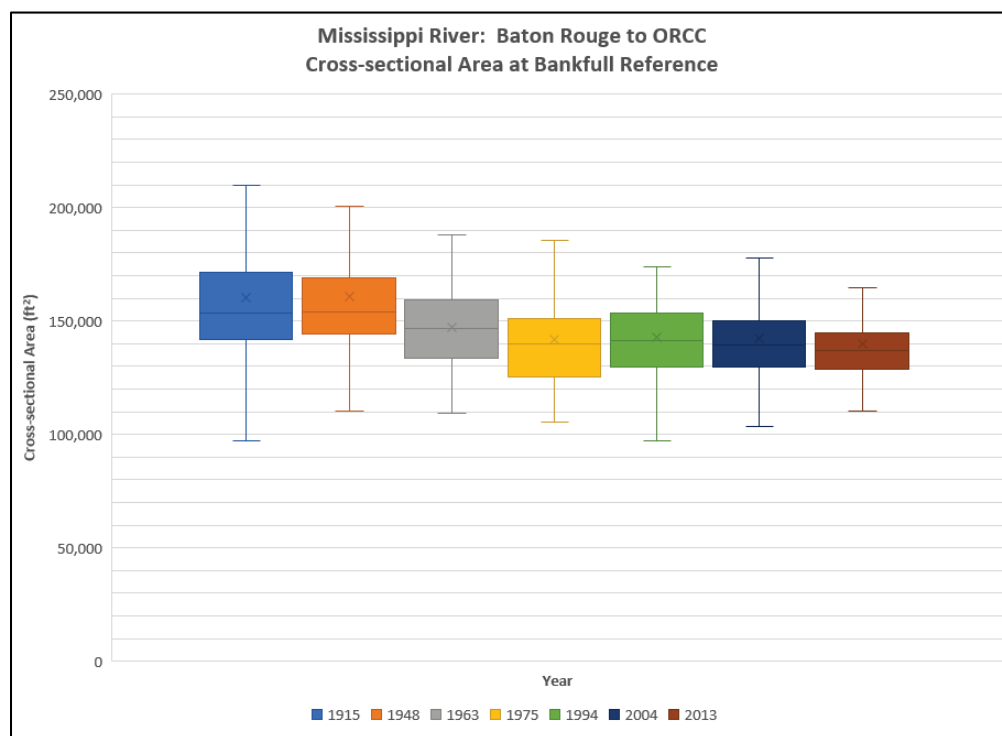


Figure 14. Mississippi River ORCC to Natchez, cross-sectional area at bankfull reference.

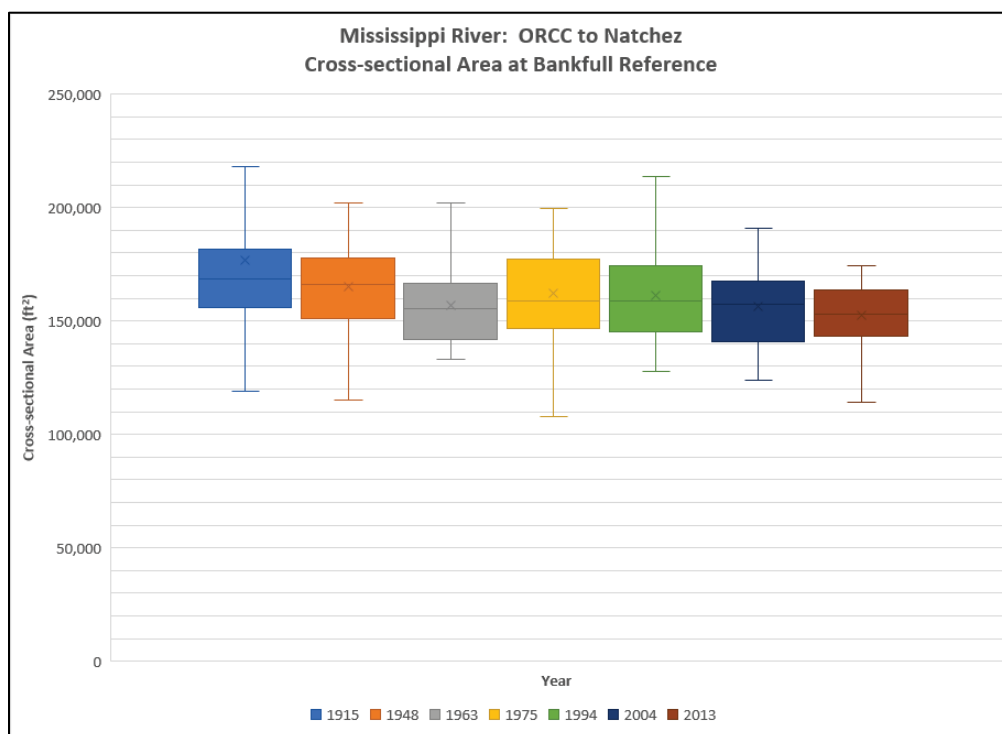


Figure 15. Mississippi River Natchez to Vicksburg, cross-sectional area at bankfull reference.

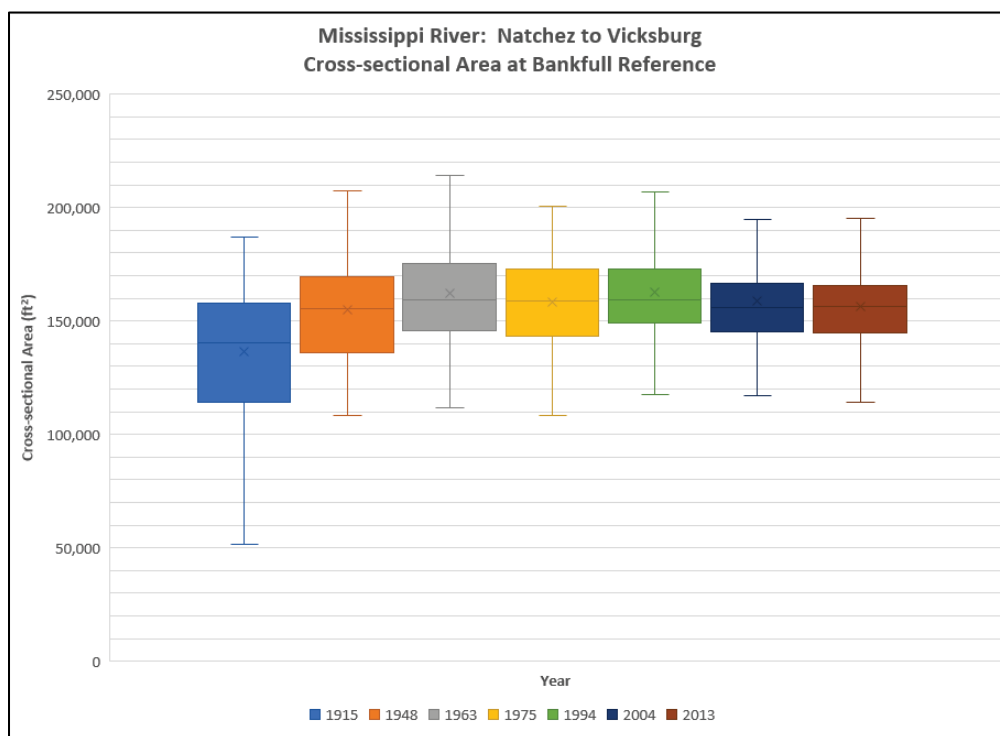


Figure 16. Mississippi River Baton Rouge to ORCC, trend plot of cross-sectional area at bankfull reference.

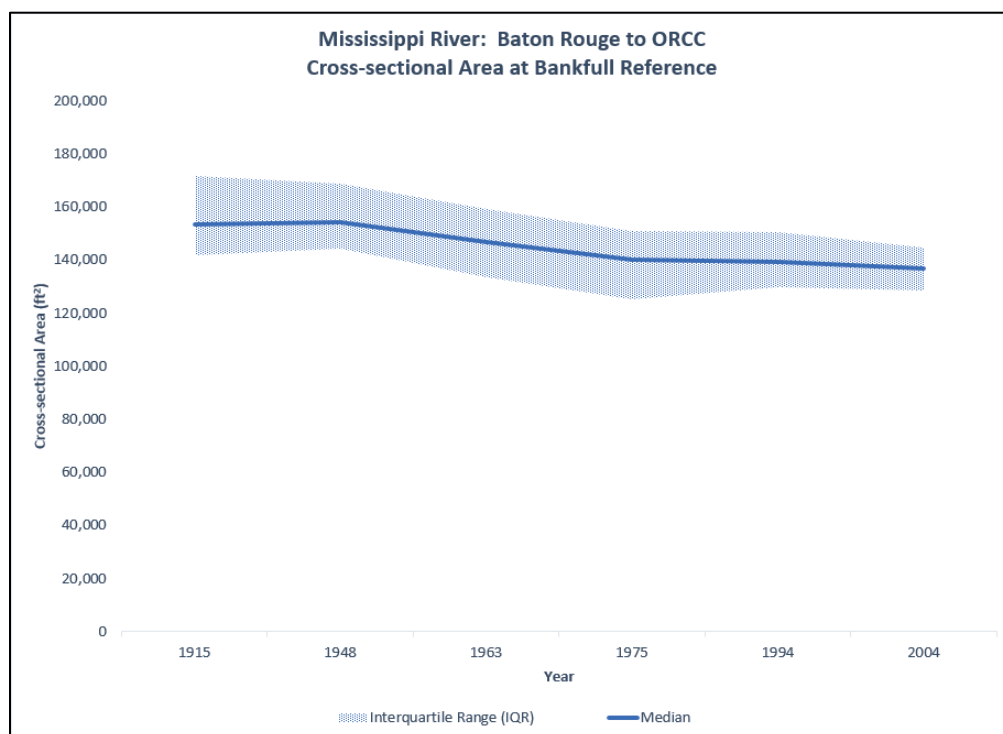


Figure 17. Mississippi River ORCC to Natchez, trend plot of cross-sectional area at bankfull reference.

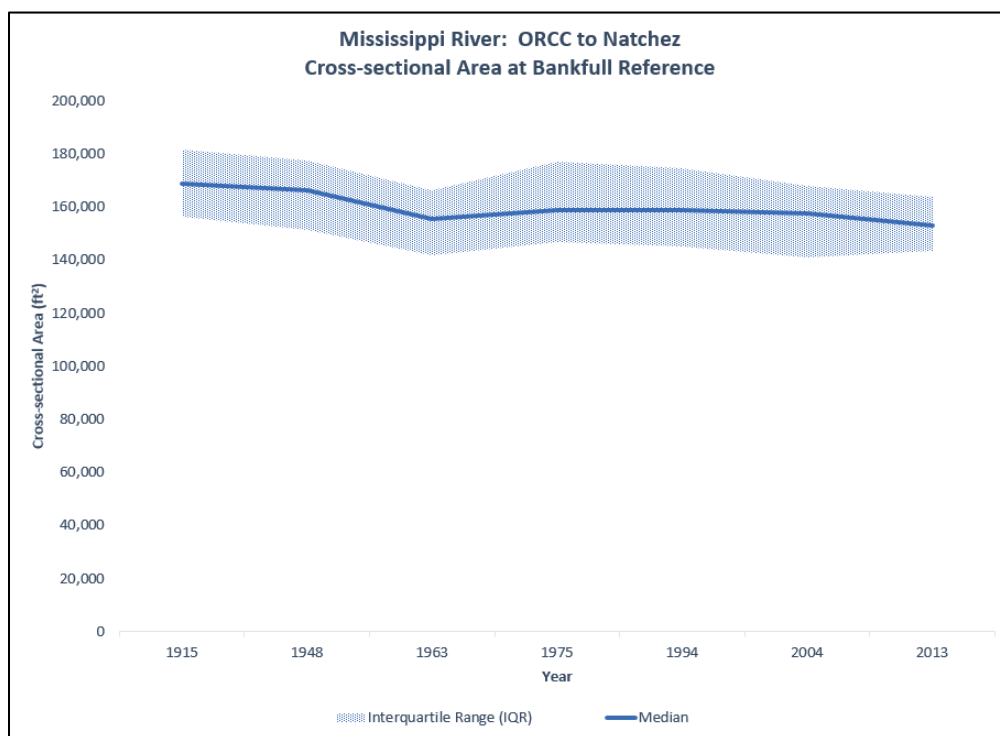
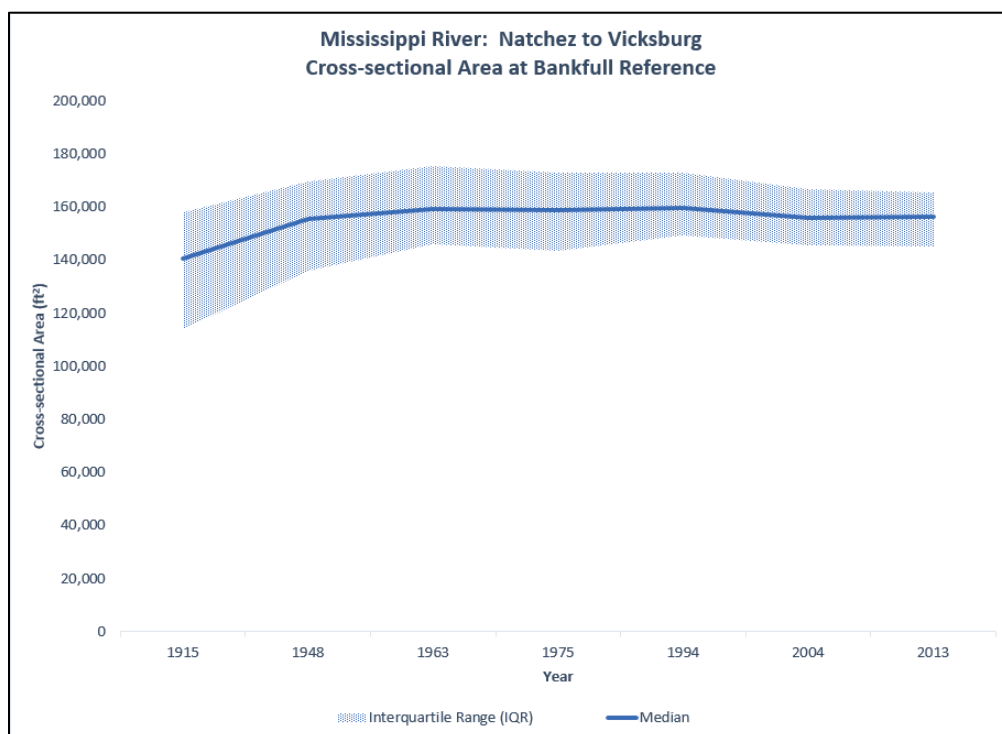


Figure 18. Mississippi River Natchez to Vicksburg, trend plot of cross-sectional area at bankfull reference.



3.1.2 Width–Mississippi River

Box-and-whisker plots of the computed channel width referenced to the LWRP for the Mississippi River geomorphic reaches are shown in Figures 19 through 21. The widths were computed as the water edge-to-water edge distance at the reference plane elevation. In the case of the Mississippi River, there are often side channels formed behind islands or large bars that are wetted at the reference plane elevation. The computed widths that are reported include the width of any side channel in addition to the width of the main channel. For the Baton Rouge-to-ORCC reach of the Mississippi River, width is fairly consistent over the time period 1915 to 2013, as shown in Figure 19. However, there is observed minor variation and fluctuation in the computed width. The minimum median width for this reach occurs in 1988, which was characterized by a severe drought (prolonged extreme low water) period. Otherwise, the width is generally consistent.

Figure 20 illustrates the median width value to be very consistent for the reach ORCC to Natchez over the entire time period, although there is minor fluctuation in the IQR. There is more observed variation in median width for the Natchez to Vicksburg reach, as indicated in Figure 21. The median width shows a general increasing trend from 1915 to 1988, followed by a general decreasing trend from 1988 to 2013. This observed width adjustment may be a result of meander bend cutoffs that were more prevalent in this reach. Also, the construction of stone dikes and other river training structures has been generally more numerous in this reach, comparatively, and may be a contributor to the observed width adjustments.

The trend plots shown in Figures 22 through 24 perhaps provide better visualization of the trends in channel width. The trend plot for the Baton Rouge-to-ORCC reach, as shown in Figure 22, indicates a slight decrease in median width over the 1915 to 1998 time period, followed by an increase in 1994, then a fairly consistent to slightly decreasing width from 1994 to 2013. Figure 23 indicates the median width for the ORCC-to-Natchez reach to be very consistent over the entire time period. The trend plot for the Natchez-to-Vicksburg reach, as shown in Figure 24, illustrates how median width has been more dynamic over time, with the increasing trend over the 1915 to 1988 time period, the decreasing trend from 1988 to 1994, and a stable to slightly decreasing trend from 1994 to 2013.

Figure 19. Mississippi River Baton Rouge to ORCC, channel width at low water reference.

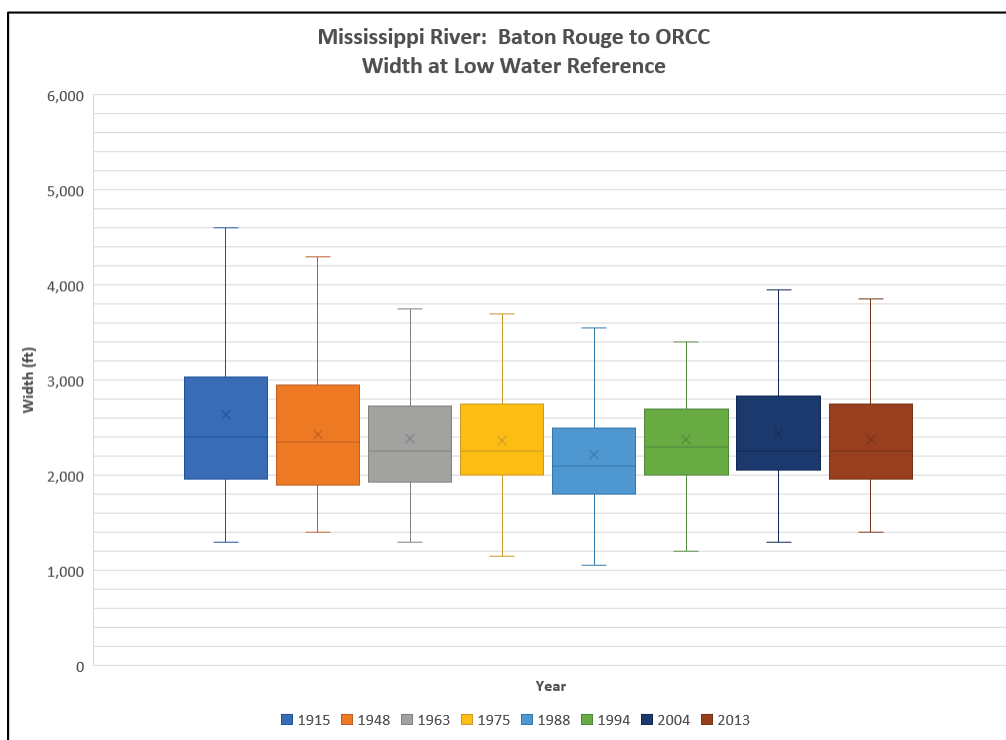


Figure 20. Mississippi River ORCC to Natchez, channel width at low water reference.

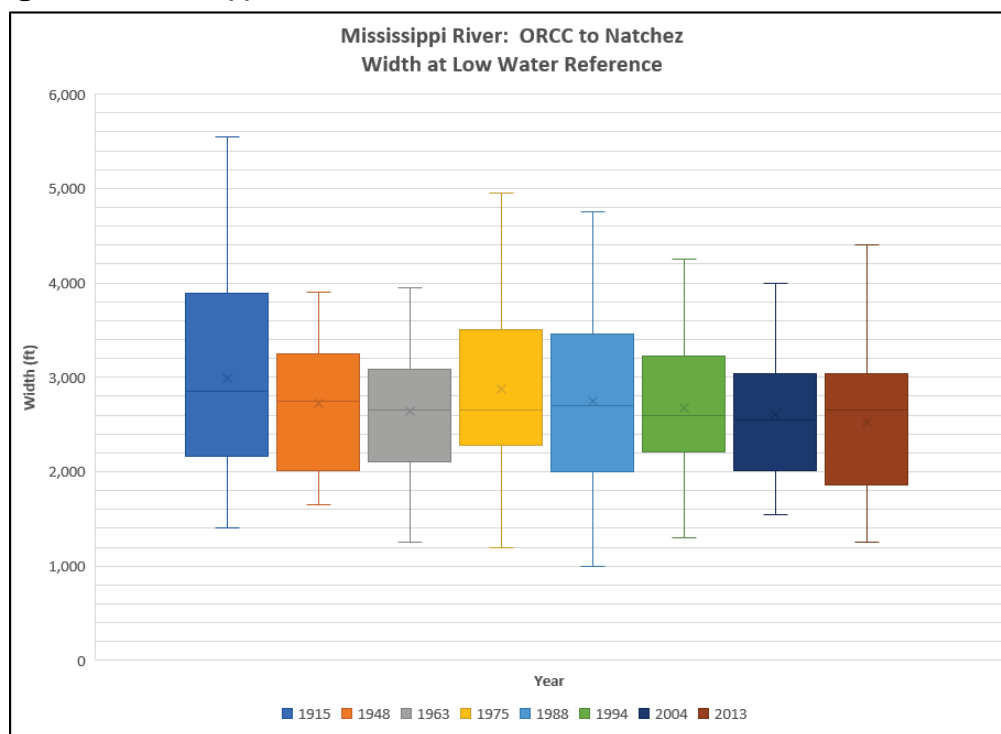


Figure 21. Mississippi River Natchez to Vicksburg, channel width at low water reference.

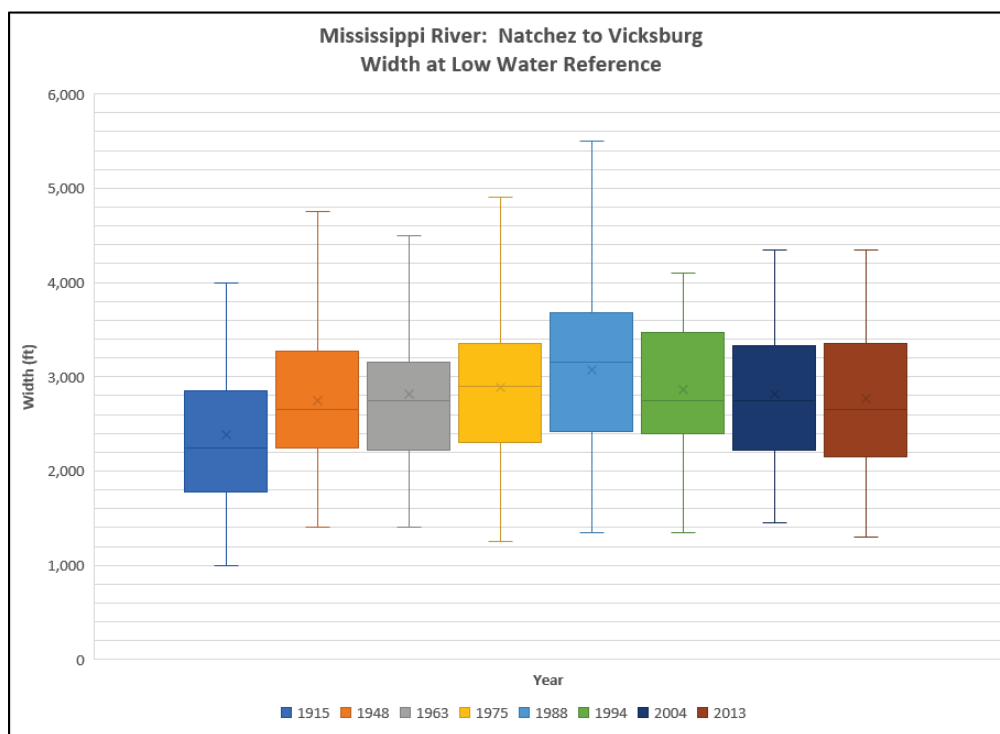


Figure 22. Mississippi River Baton Rouge to ORCC, trend plot of channel width at low water reference.

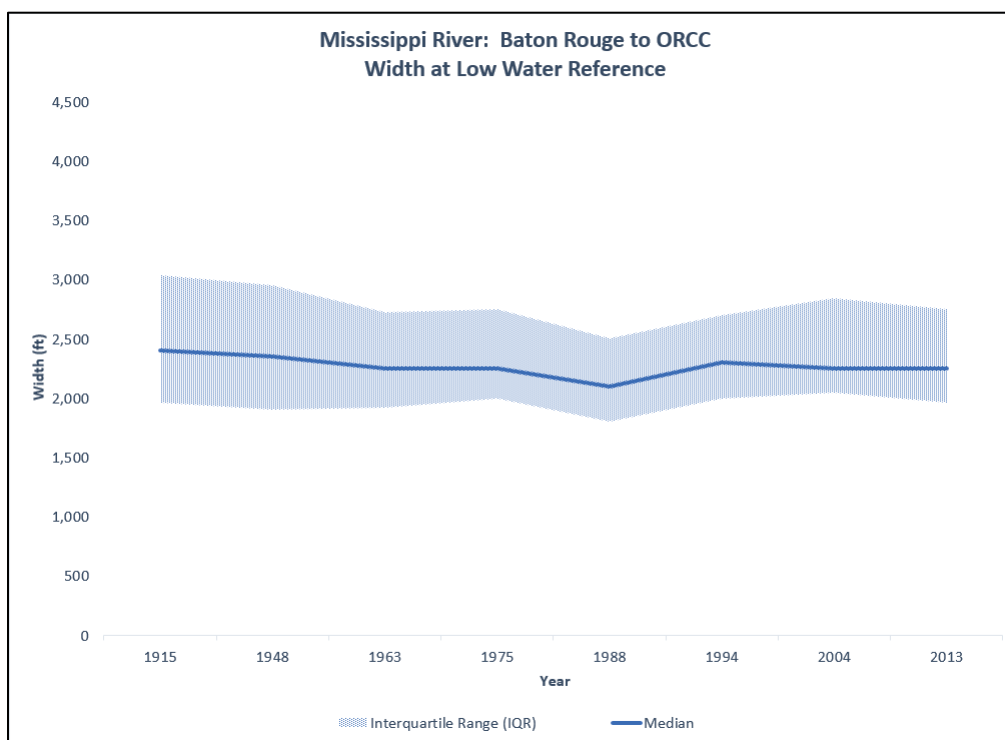


Figure 23. Mississippi River ORCC to Natchez, trend plot of channel width at low water reference.

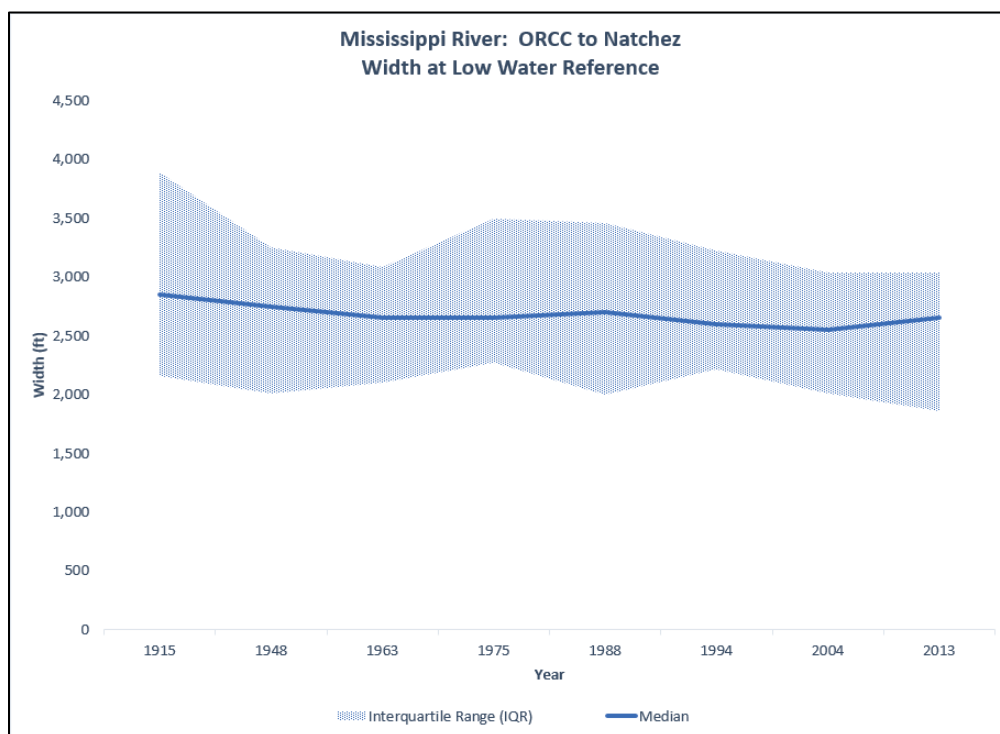
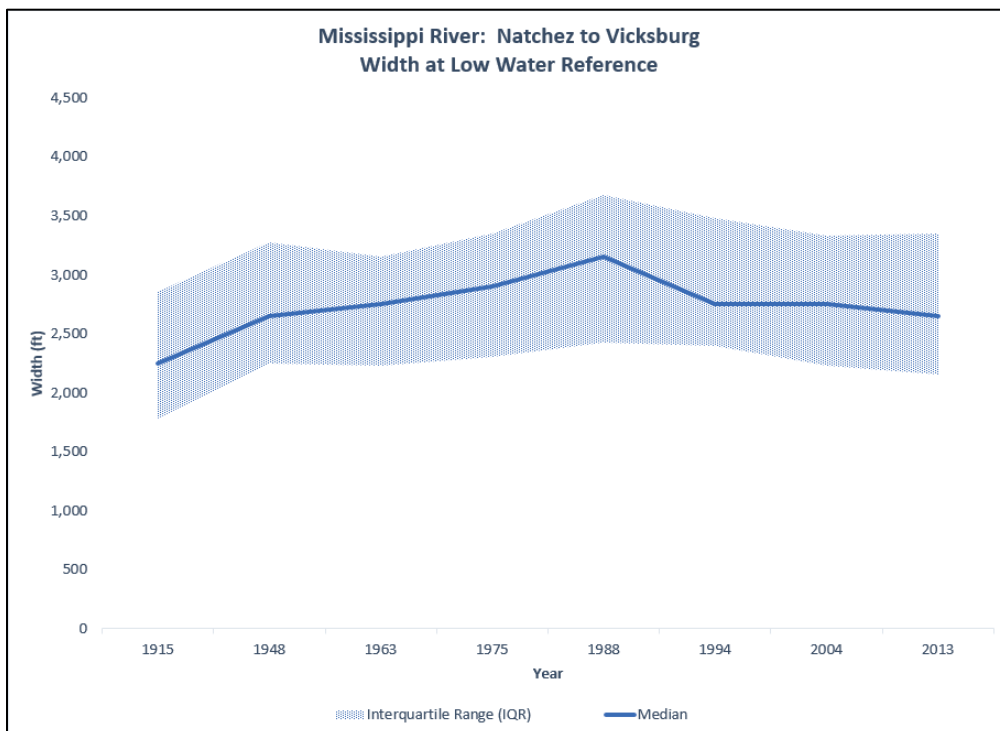


Figure 24. Mississippi River Natchez to Vicksburg, trend plot of channel width at low water reference.



Box-and-whisker plots of the computed channel width referenced to bankfull reference plane for the Mississippi River geomorphic reaches are shown in Figures 25 through 27. In Figure 25, the box-and-whisker plot for the Baton Rouge-to-ORCC reach indicates more variation than the low water referenced data. The plot shows an increase in median width from 1915 to 1948 and a stable to slight increasing trend from 1948 to 2013. In general, the extent of survey data coverage will typically bias the computed width on the lower side due to shallow depths that may be inaccessible by the survey boat.

For the ORCC-to-Natchez reach, Figure 26 indicates an increase in width from 1915 to 1948, followed by a decreasing trend from 1948 to 1975, and then was fairly consistent from 1975 to 2013. Figure 27 indicates the median width for the Natchez-to-Vicksburg reach to be variable, with an increase from 1915 to 1948, a decrease from 1963 to 1975, followed by an increase from 1975 to 1994. The trend from 1994 to 2013 does not indicate a change.

Figure 25. Mississippi River Baton Rouge to ORCC, channel width at bankfull reference.

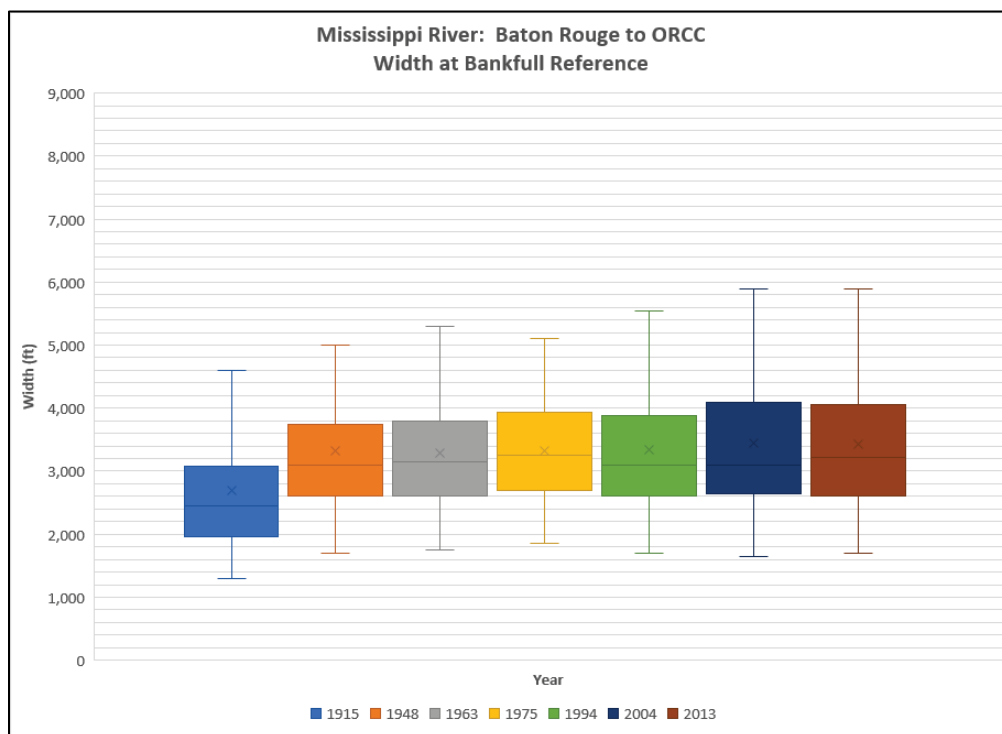


Figure 26. Mississippi River ORCC to Natchez, channel width at bankfull reference.

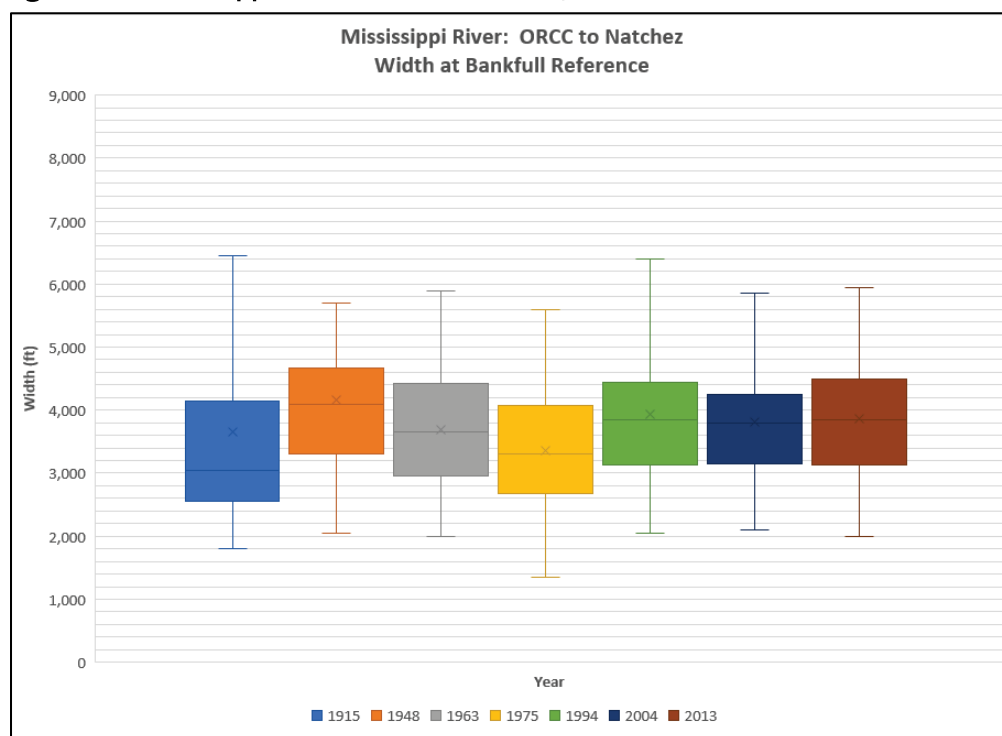
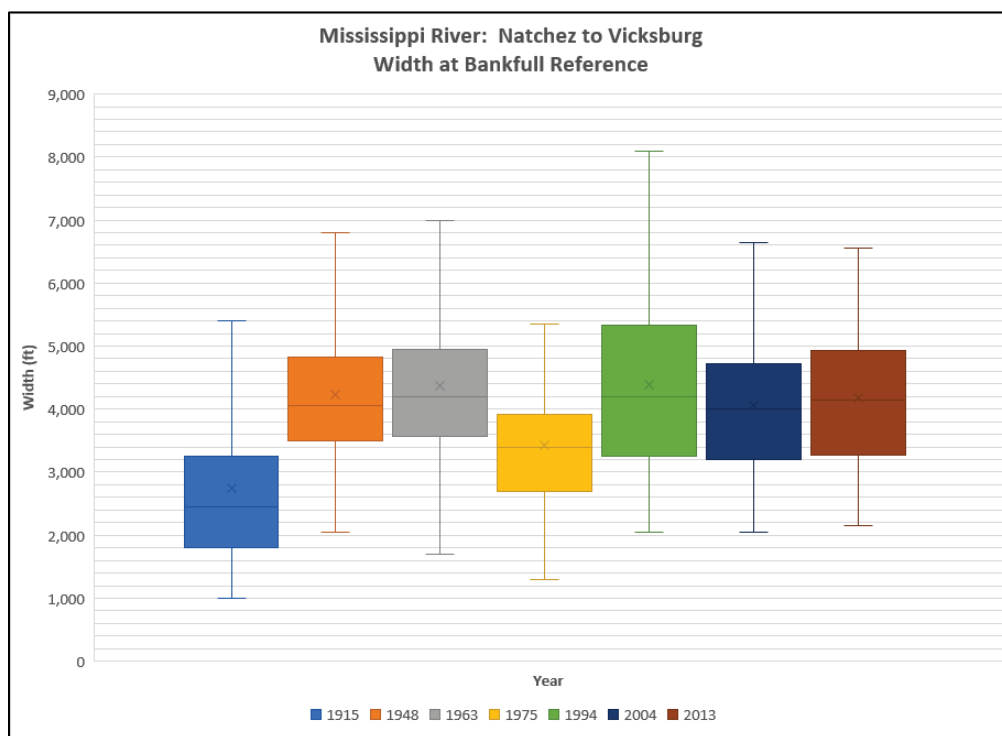


Figure 27. Mississippi River Natchez to Vicksburg, channel width at bankfull reference.



The trend plots shown in Figures 28 through 30 for the channel width referenced to bankfull all indicate a notable increase in width from 1915 to 1948. Although it is difficult to state with certainty, this pattern may be a function of the limited extent of bathymetric data for the 1915 survey. The trend plots for all three reaches also indicate a temporary decrease in width for 1975, then a return to fairly consistent values thereafter. Again, it is difficult to state with certainty, but these observed temporary decreases may be due to the extent of survey data available.

Figure 28. Mississippi River Baton Rouge to ORCC, trend plot of channel width at bankfull reference.

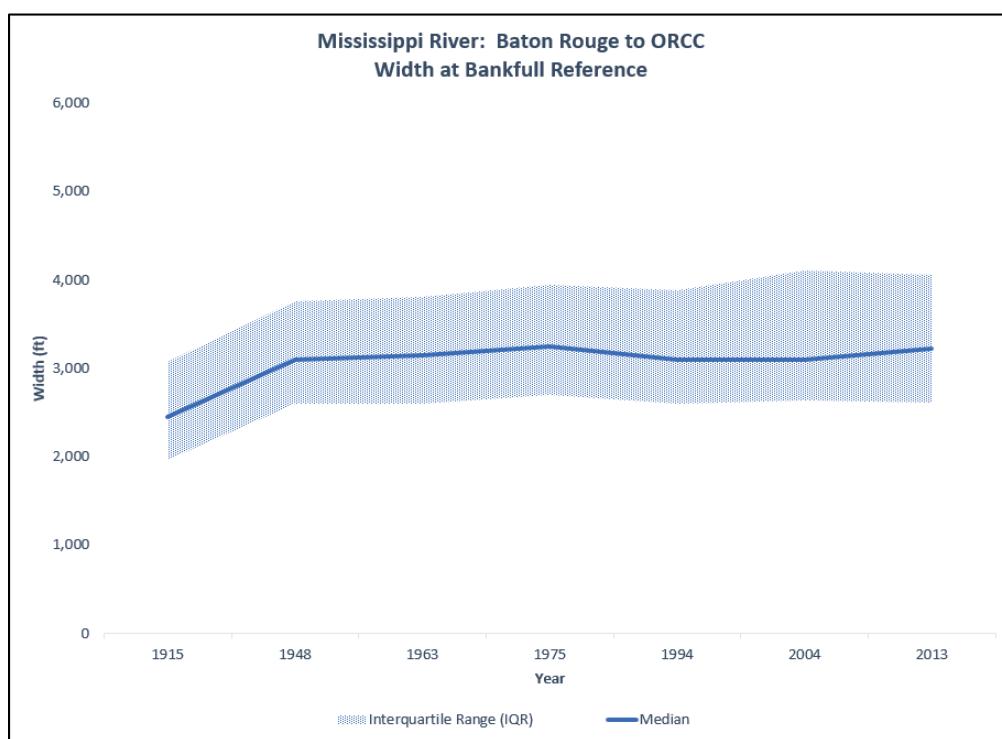


Figure 29. Mississippi River ORCC to Natchez, trend plot of channel width at bankfull reference.

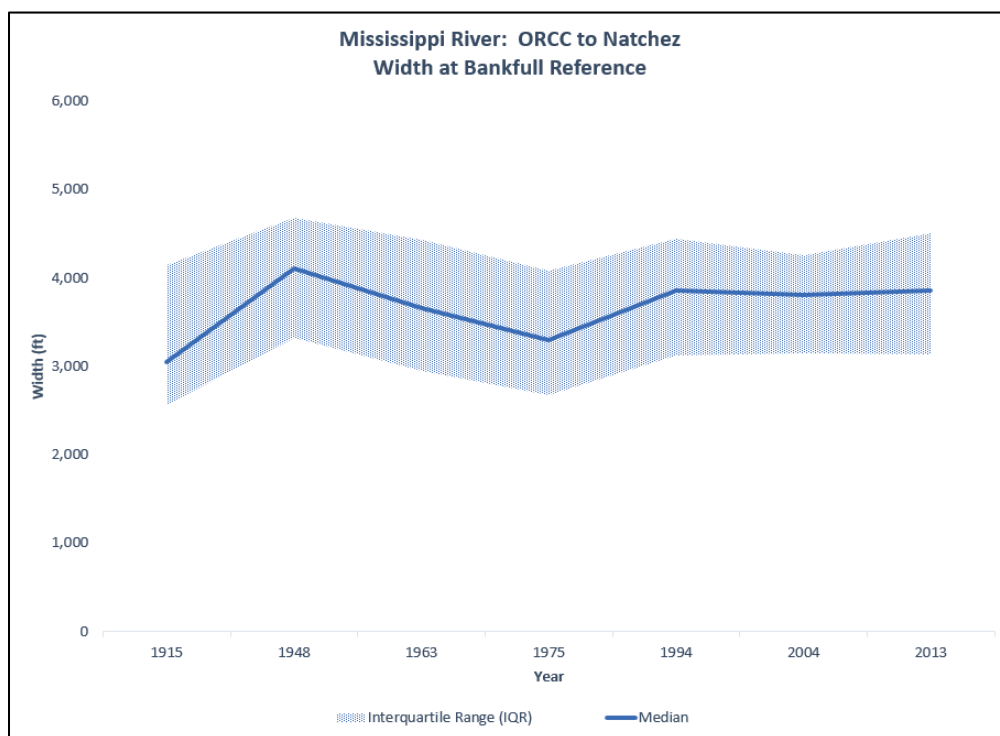
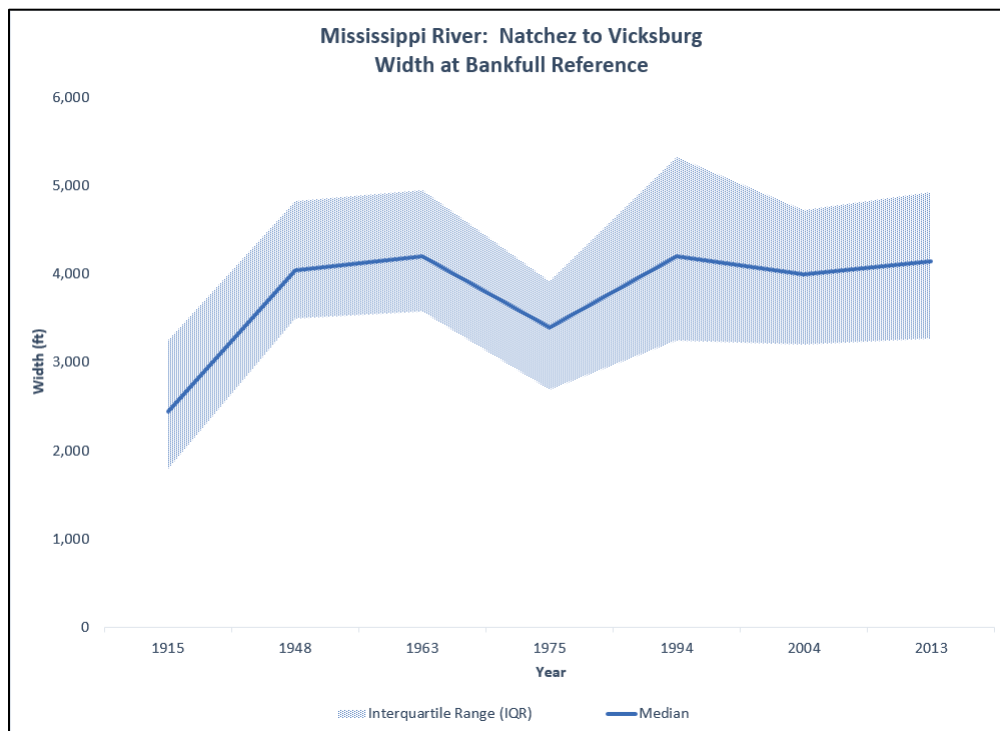


Figure 30. Mississippi River Natchez to Vicksburg, trend plot of channel width at bankfull reference.



3.1.3 Hydraulic depth–Mississippi River

The hydraulic depth as reported herein is a computed value based on the cross-sectional area divided by the width. For wide rivers such as the Lower Mississippi River, this provides a reasonable representation of the mean depth in the channel. Box-and-whisker plots of the computed hydraulic depth referenced to the LWRP for the Mississippi River geomorphic reaches are shown in Figures 31 through 33. Figure 31 indicates the median hydraulic depth for the Baton Rouge to ORCC reach decreases from 1915 to 1975, and with the exception of a slight increase in 1988, the hydraulic depth remains fairly stable from 1975 to 2013.

Figure 32 indicates that for the reach ORCC to Natchez, median hydraulic depth decreased from 1915 to 1948 and then was relatively stable with a slight increase in depth from 1948 to 2013. Figure 33 shows a similar pattern for the Natchez-to-Vicksburg reach, with the exception of a slight decrease in hydraulic depth in the 1988 time period.

Figure 31. Mississippi River Baton Rouge to ORCC, hydraulic depth at low water reference.

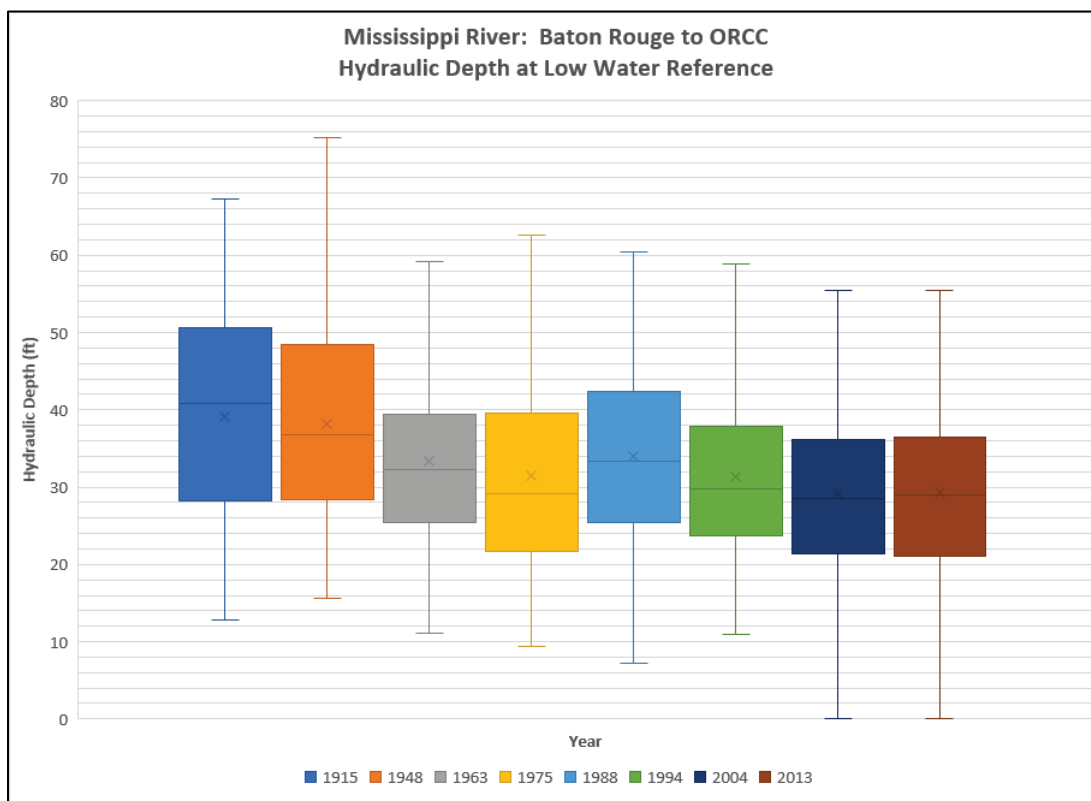


Figure 32. Mississippi River ORCC to Natchez, hydraulic depth at low water reference.

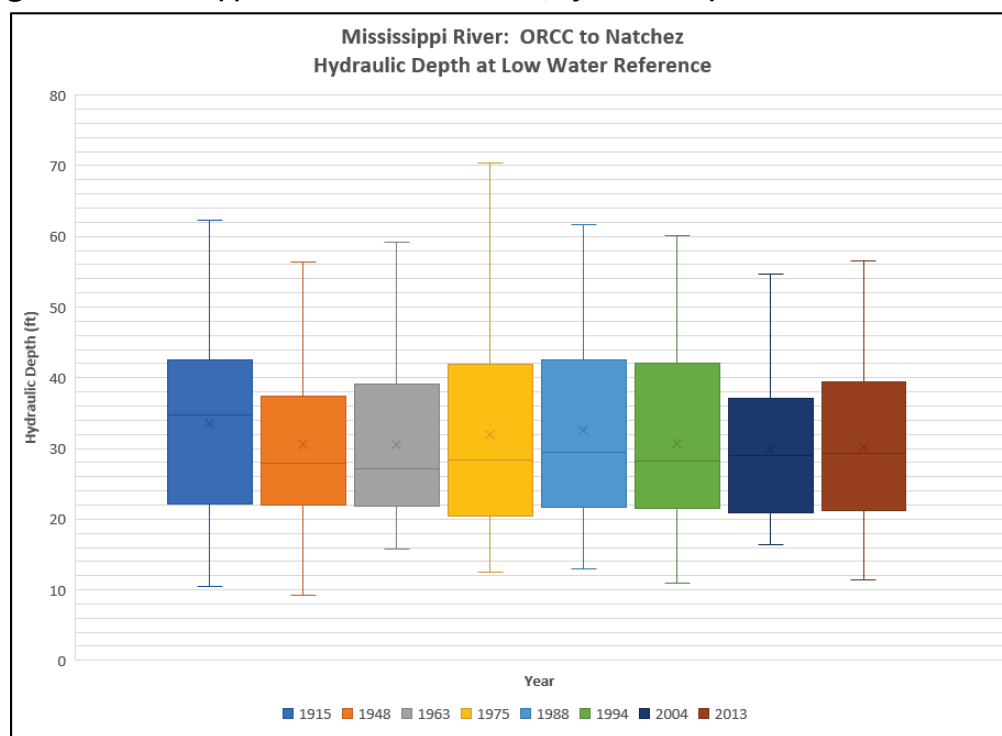
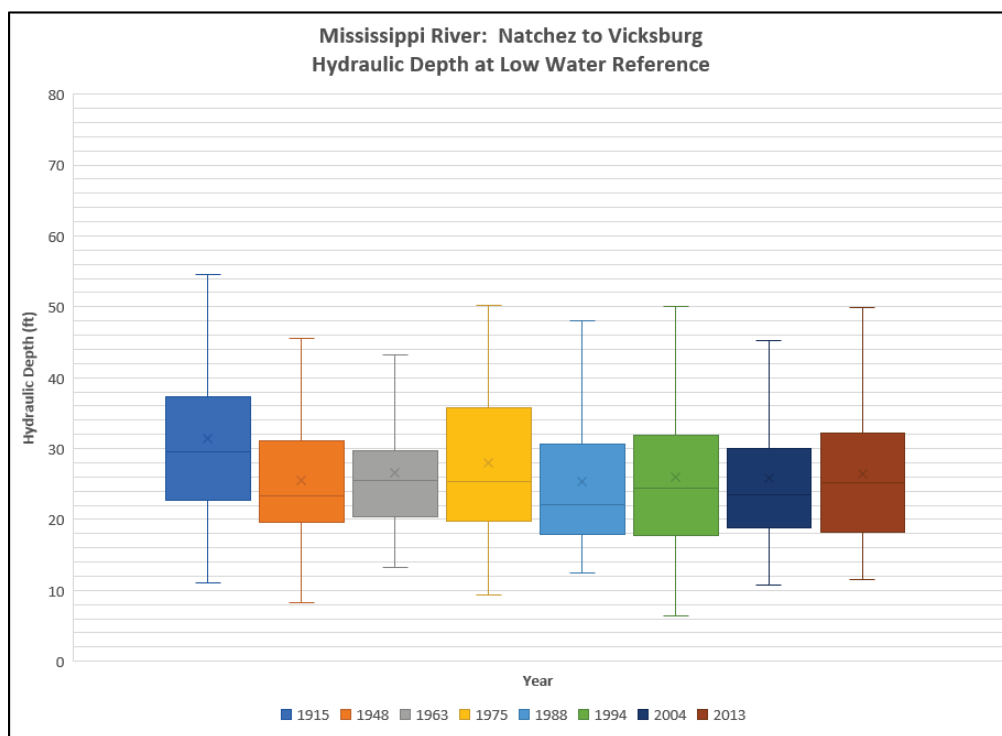


Figure 33. Mississippi River Natchez to Vicksburg, hydraulic depth at low water reference.



The trend plots of hydraulic depth for the three Mississippi River geomorphic reaches are shown in Figures 34 through 36. Figure 34 shows hydraulic depth in the Baton Rouge-to-ORCC reach decreased from 1915 to approximately 1975, increased from 1975 to 1988, slightly decreased from 1988 to 1994, and from that point forward has remained fairly consistent. Figure 35 indicates hydraulic depth decreased from 1915 to 1948 for the ORCC-to-Natchez reach, then was stable to slightly increasing from 1948 to 2013. Figure 36 shows the same decreasing trend in hydraulic depth from 1915 to 1948 for the Natchez-to-Vicksburg reach, a slight increase through 1963 and 1975, a slight decrease from 1975 to 1988, and then a slight increasing trend from 1988 to 2013.

Figure 34. Mississippi River Baton Rouge to ORCC, trend plot of hydraulic depth at low water reference.

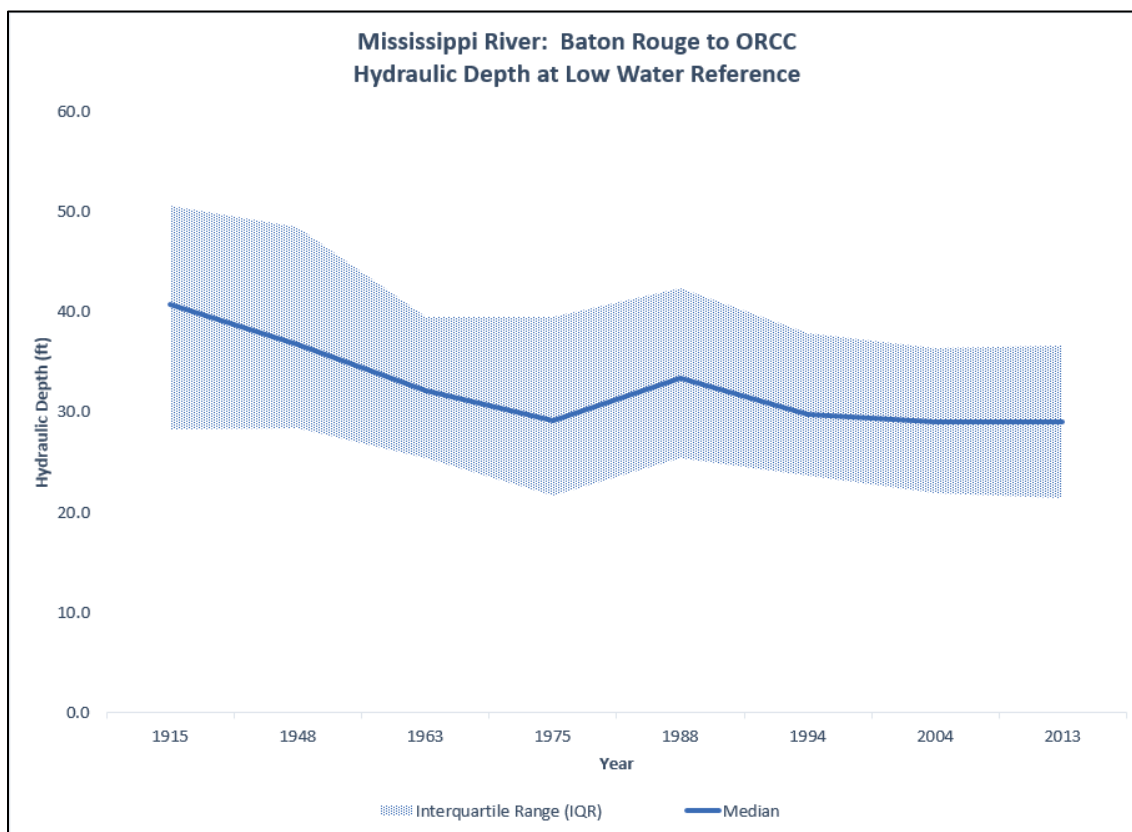


Figure 35. Mississippi River ORCC to Natchez, trend plot of hydraulic depth at low water reference.

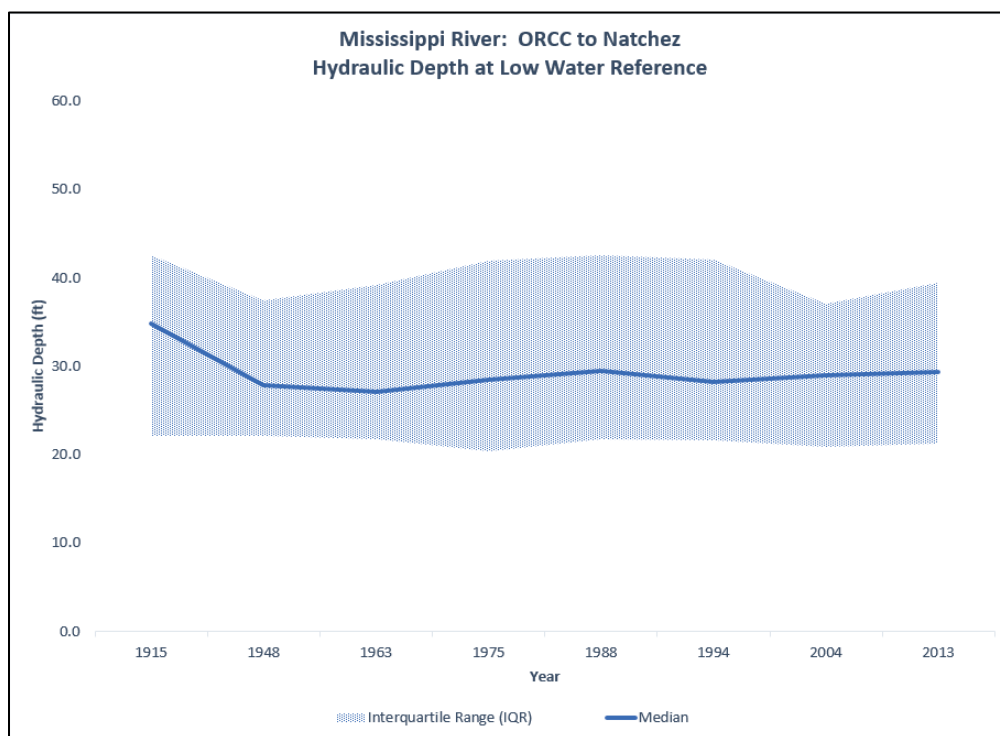
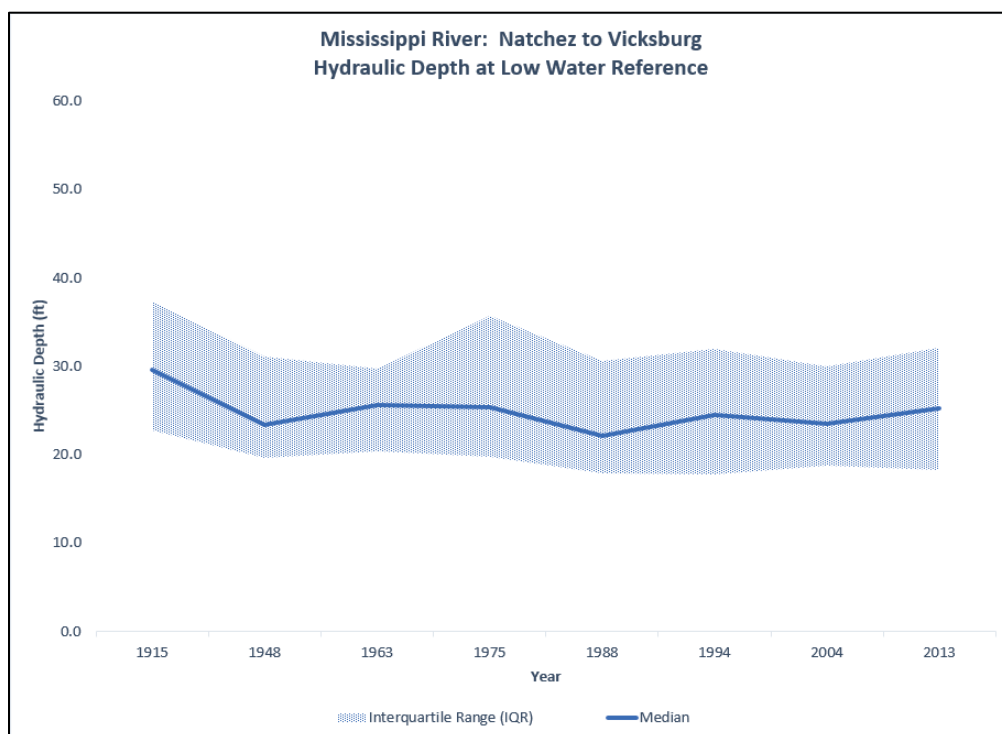


Figure 36. Mississippi River Natchez to Vicksburg, trend plot of hydraulic depth at low water reference.



Box-and-whisker plots of the computed hydraulic depth referenced to bankfull reference plane for the Mississippi River geomorphic reaches are shown in Figures 37 through 39. Figure 37 indicates the same decrease in depth from 1915 to 1948, and data shows a stable to slight decrease in depth from 1948 to 2013. For the ORCC-to-Natchez reach, Figure 38 indicates the same decrease in depth from 1915 to 1948, then a varying but overall steady trend from 1948 to 2013. Similarly, the same trend pattern is shown in Figure 39 for the Natchez-to-Vicksburg reach, with the exception of the temporary increase in depth in 1975.

The trend plots of hydraulic depth for all Mississippi River geomorphic reaches are shown in Figures 40 through 42 for visualization purposes. Across all these reaches, there appears to be a decrease in hydraulic depth following the 1915 survey. Subsequent to the 1915 survey, identifying a consistent trend is difficult.

Figure 37. Mississippi River Baton Rouge to ORCC, hydraulic depth at bankfull reference.

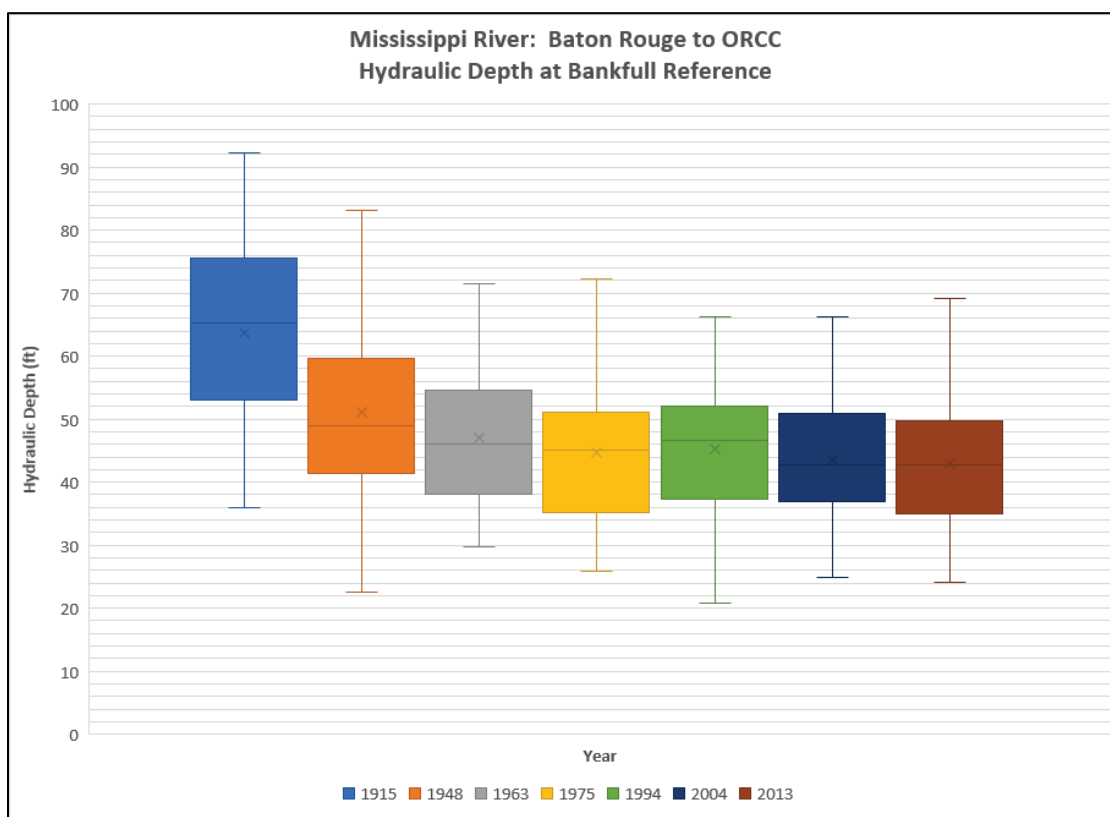


Figure 38. Mississippi River ORCC to Natchez, hydraulic depth at bankfull reference.

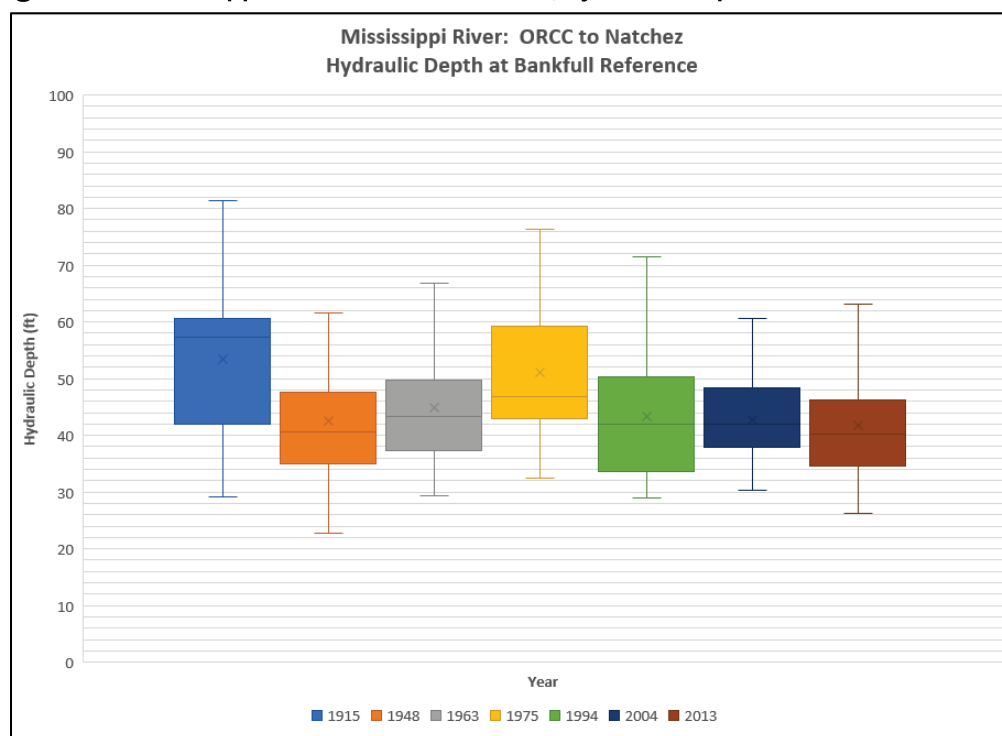


Figure 39. Mississippi River Natchez to Vicksburg, hydraulic depth at bankfull reference.

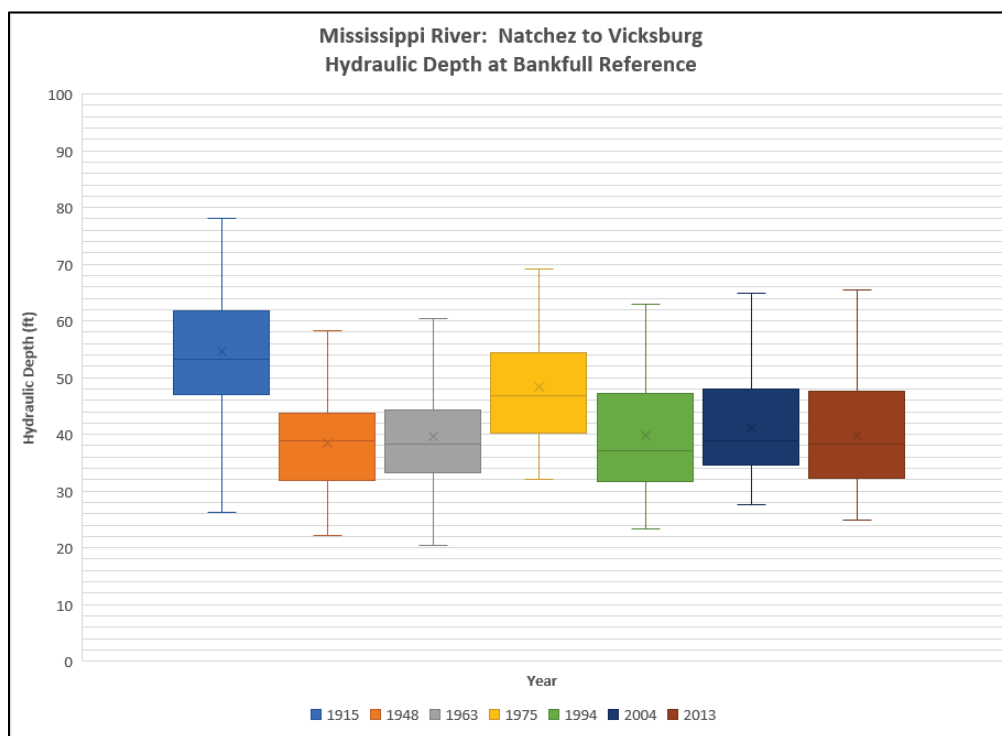


Figure 40. Mississippi River Baton Rouge to ORCC, trend plot of hydraulic depth at bankfull reference.

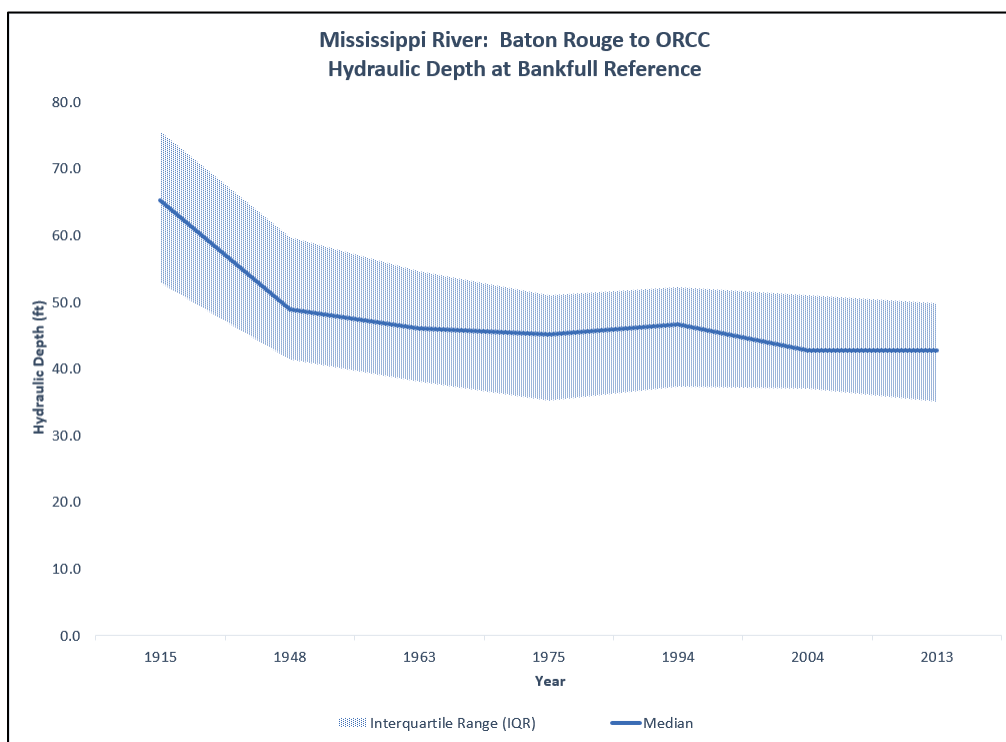


Figure 41. Mississippi River ORCC to Natchez, trend plot of hydraulic depth at bankfull reference.

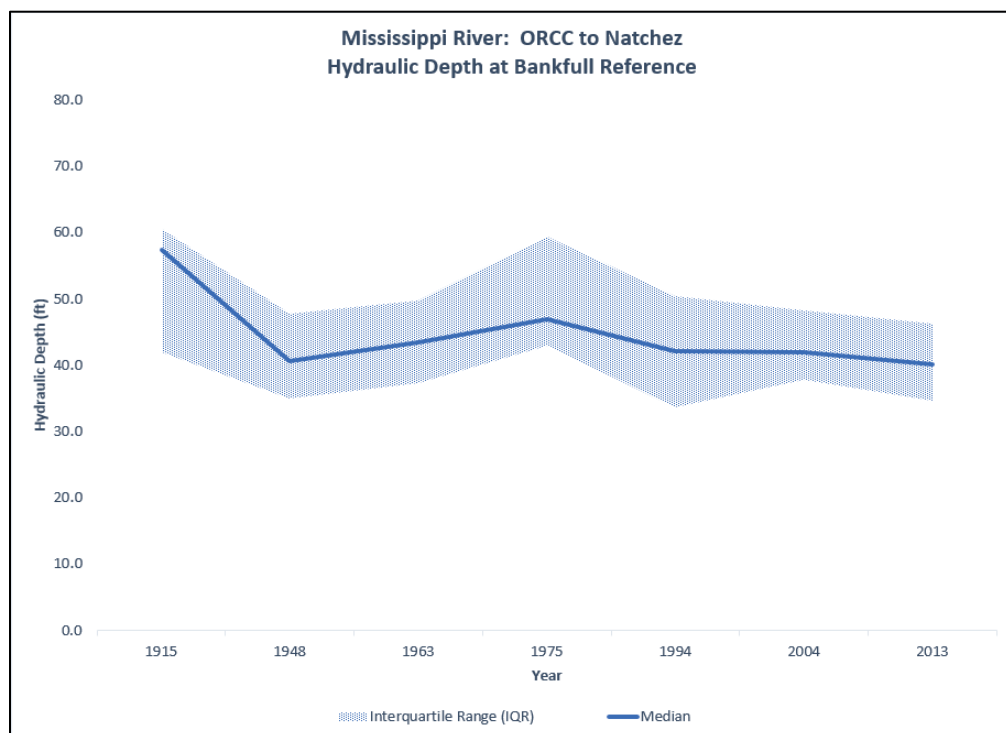
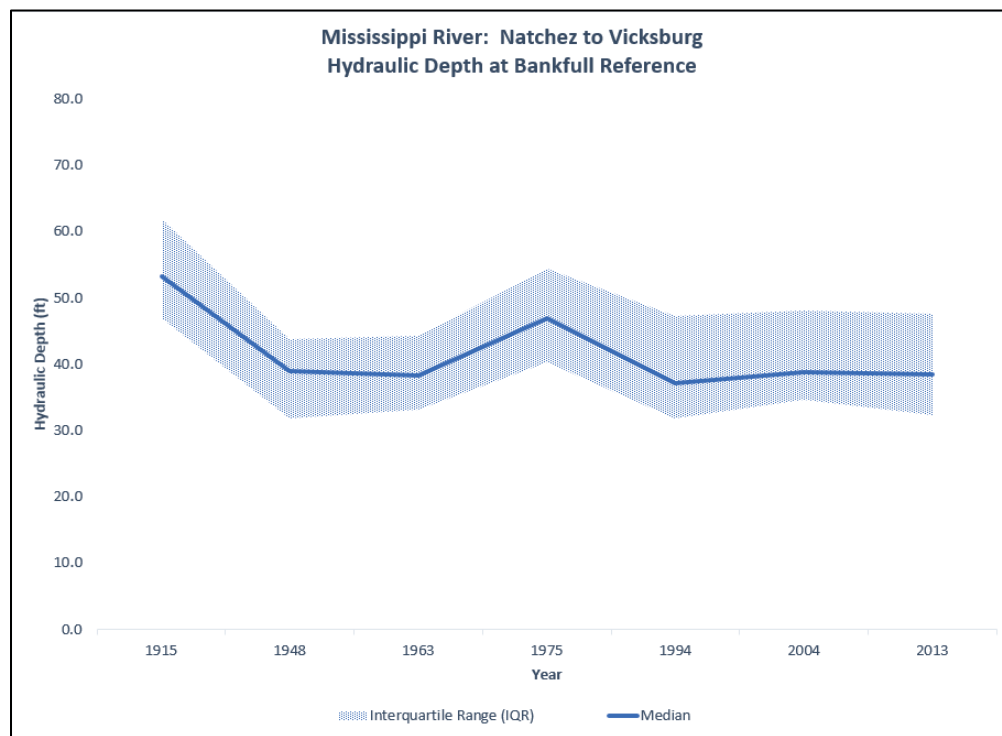


Figure 42. Mississippi River Natchez to Vicksburg, trend plot of hydraulic depth at bankfull reference.



3.1.4 Conveyance–Mississippi River

Similar to hydraulic depth, the conveyance reported herein is a computed value based on the cross-sectional area multiplied by the hydraulic depth raised to the two-thirds power. Conveyance gives an indication of the flow-carrying capacity of a channel. However, the computed conveyance does not include the Manning's roughness n and thus does not indicate the actual total conveyance of the channel. Rather, it is conveyance representative of the channel geometry only, exclusive of channel roughness. Box-and-whisker plots of the computed conveyance referenced to the LWRP for the Mississippi River geomorphic reaches are shown in Figures 43 through 45. For the Baton Rouge-to-ORCC geomorphic reach, Figure 43 shows the median conveyance to decrease from 1915 to 1975, increase from 1975 to 1994, and then decrease from 1994 to 2013. Figure 44 indicates a similar cyclical pattern for the ORCC-to-Natchez reach, with the initial decreasing trend from 1915 to 1963, an increasing trend from 1963 to 1988, and another period of decreasing conveyance from 1988 to 2013. The reach from Natchez to Vicksburg displays a similar trend, as well, as shown in Figure 45, but with little change in conveyance observed from 1988 to 2013.

Figure 43. Mississippi River Baton Rouge to ORCC, conveyance at low water reference.

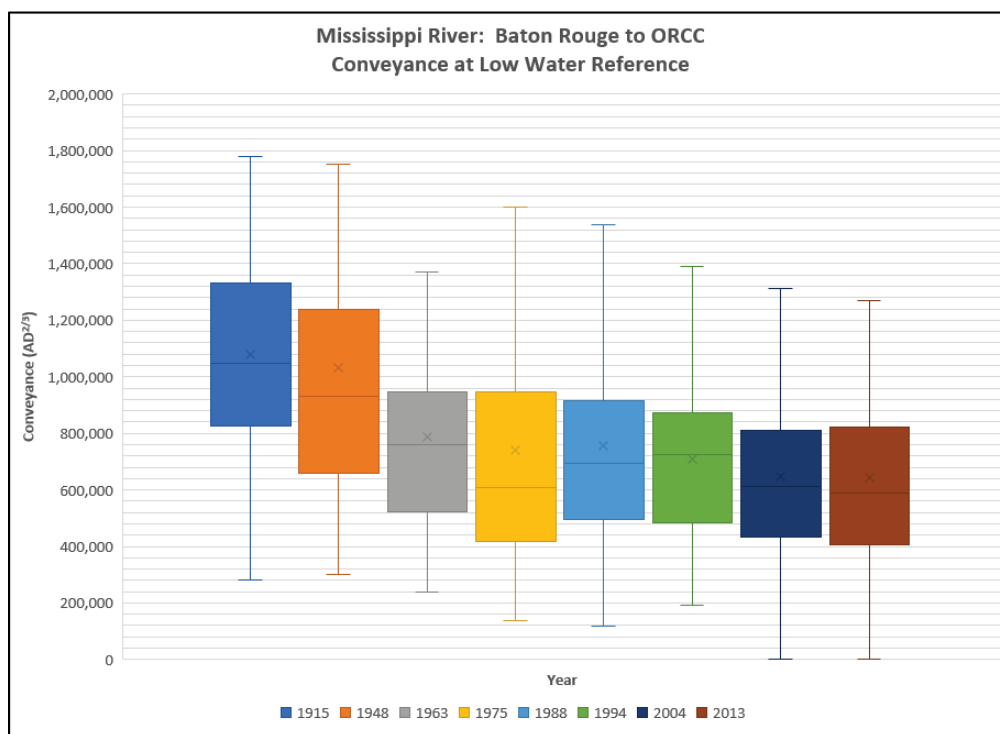


Figure 44. Mississippi River ORCC to Natchez, conveyance at low water reference.

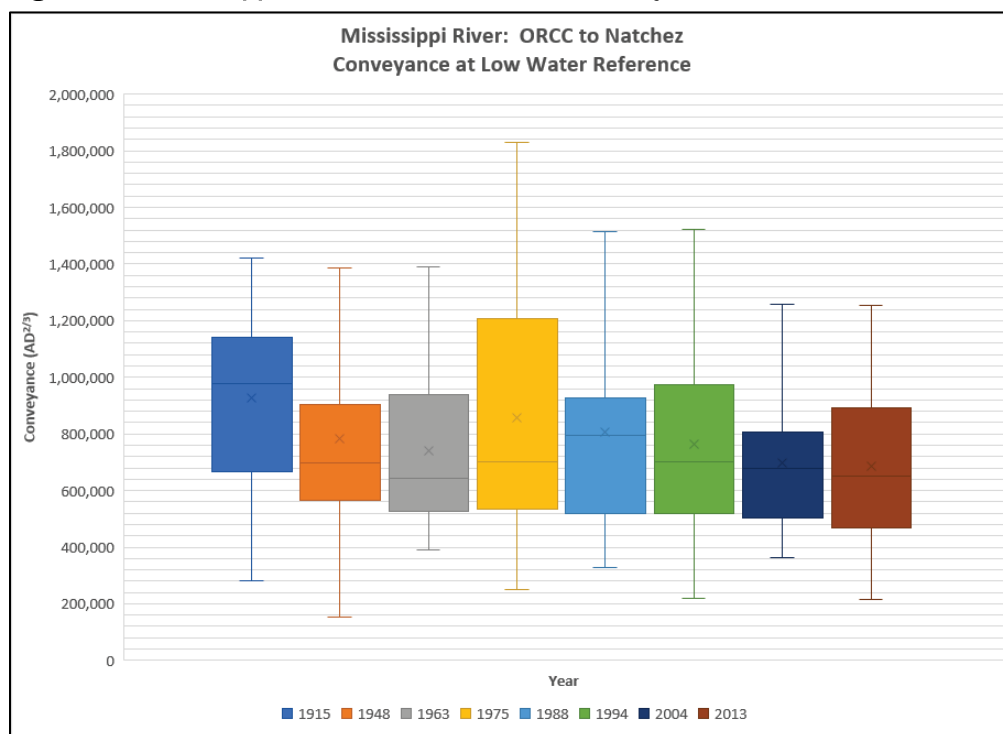
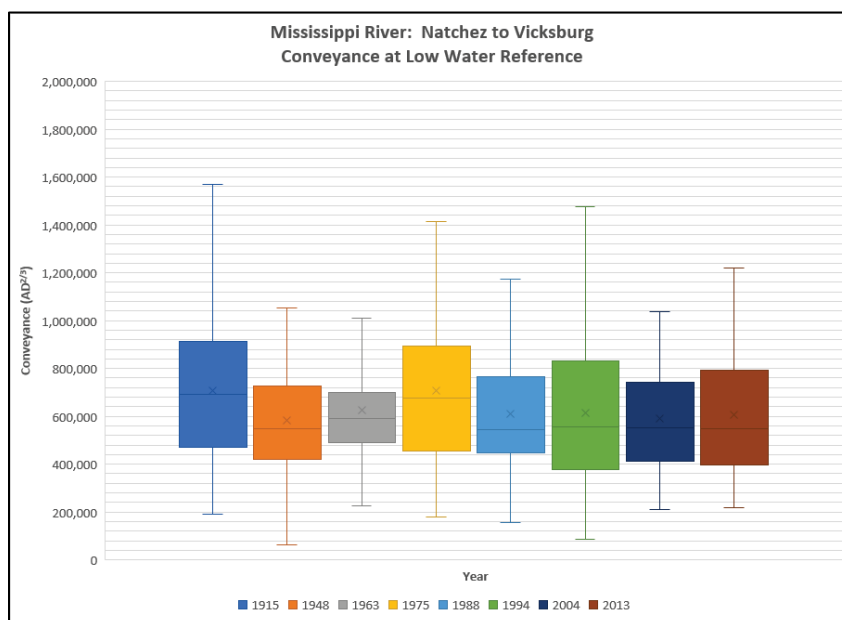


Figure 45. Mississippi River Natchez to Vicksburg, conveyance at low water reference.



The trend plots of conveyance for the Mississippi River geomorphic reaches are shown in Figures 46 through 48. In general, the trends are similar for all three reaches, with an initial decrease in median conveyance from 1915 to 1948 or 1963, then a temporary spike in conveyance around 1975 or 1988, followed by a relatively consistent to slight decrease in conveyance from 1994 to 2013.

Figure 46. Mississippi River Baton Rouge to ORCC, trend plot of conveyance at low water reference.

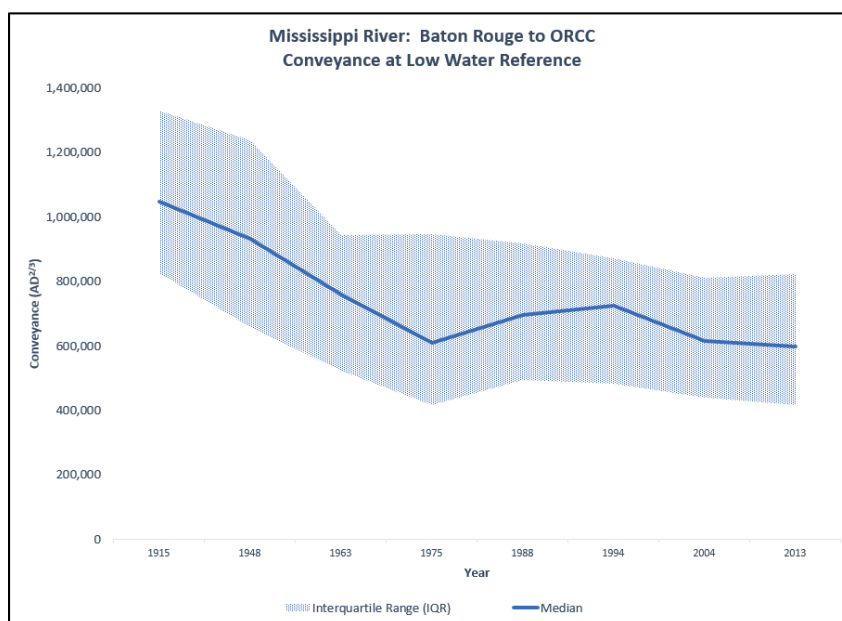


Figure 47. Mississippi River ORCC to Natchez, trend plot of conveyance at low water reference.

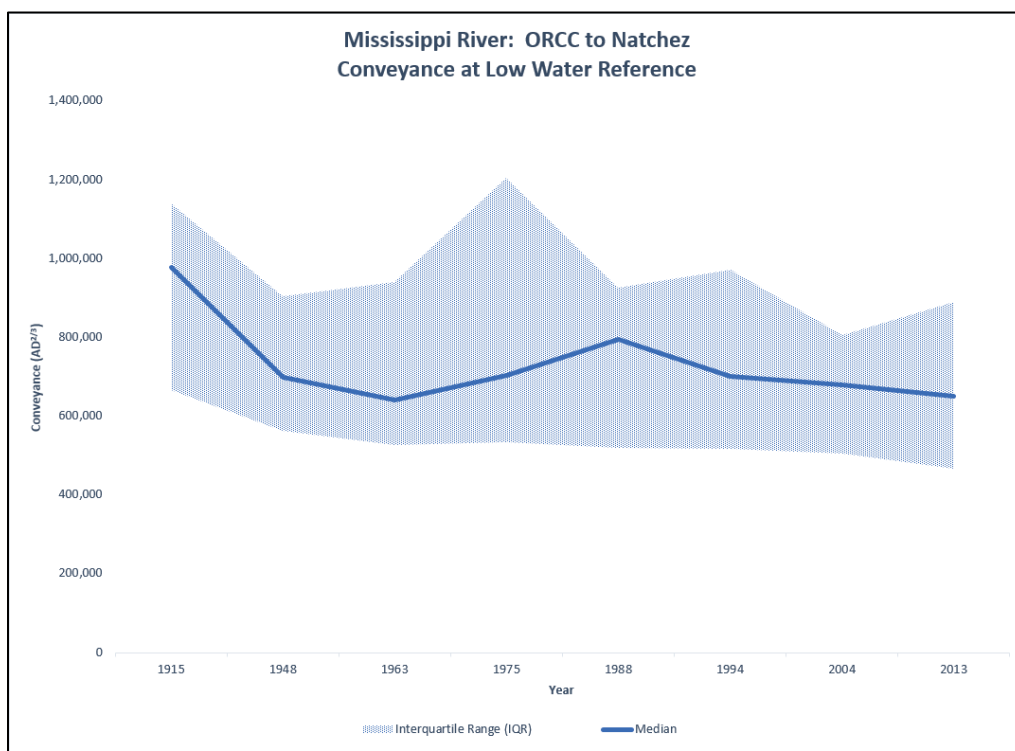
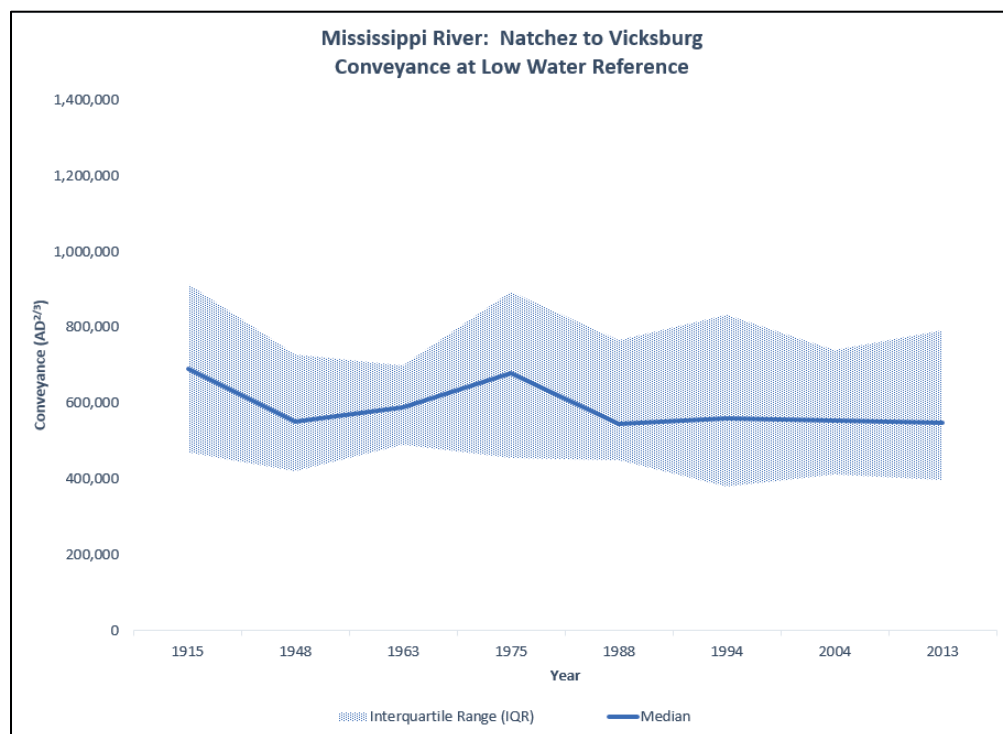


Figure 48. Mississippi River Natchez to Vicksburg, trend plot of conveyance at low water reference.



The box-and-whisker plots of conveyance referenced to bankfull for the Mississippi River geomorphic reaches are presented in Figures 49 through 51, and the trend plots of conveyance are presented in Figures 52 through 54. In general, the box-and-whisker plots and the trend plots referenced to bankfull indicate similar trends in conveyance as those referenced to low water.

Figure 49. Mississippi River Baton Rouge to ORCC, conveyance at bankfull reference.

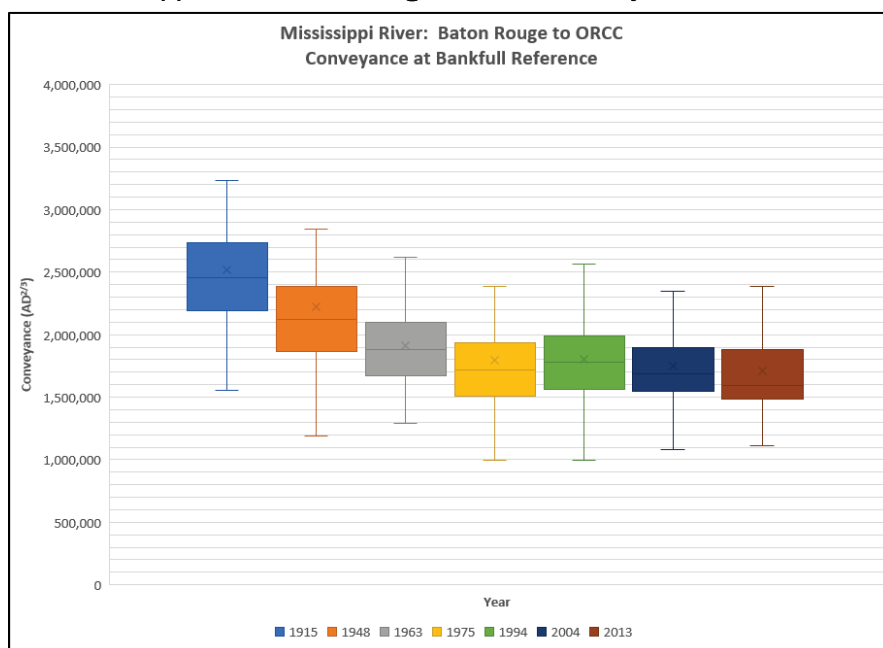


Figure 50. Mississippi River ORCC to Natchez, conveyance at bankfull reference.

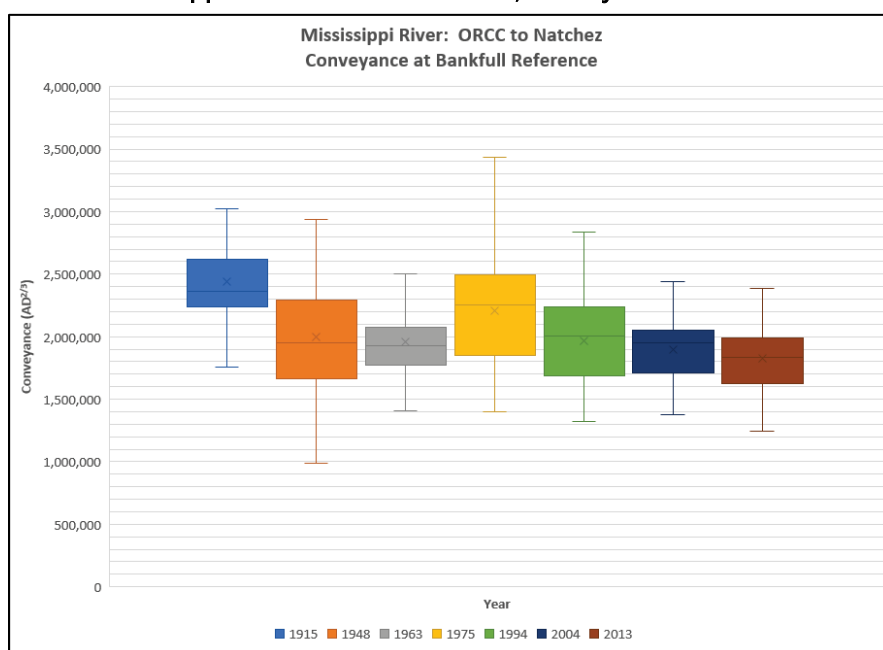


Figure 51. Mississippi River Natchez to Vicksburg, conveyance at bankfull reference.

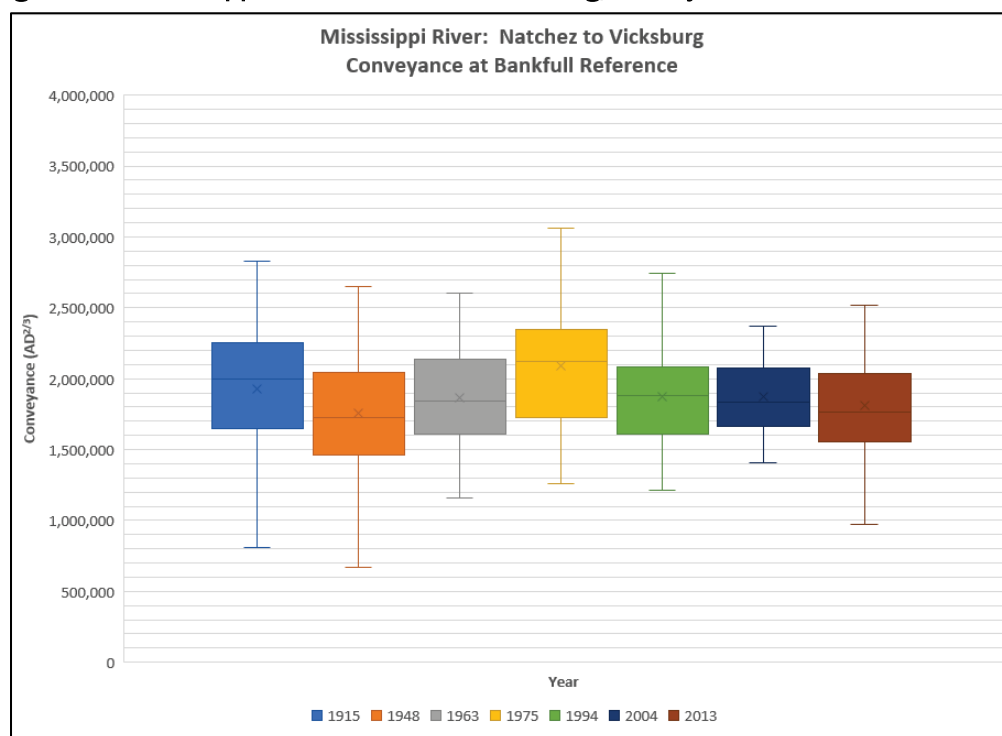


Figure 52. Mississippi River Baton Rouge to ORCC, trend plot of conveyance at bankfull reference.

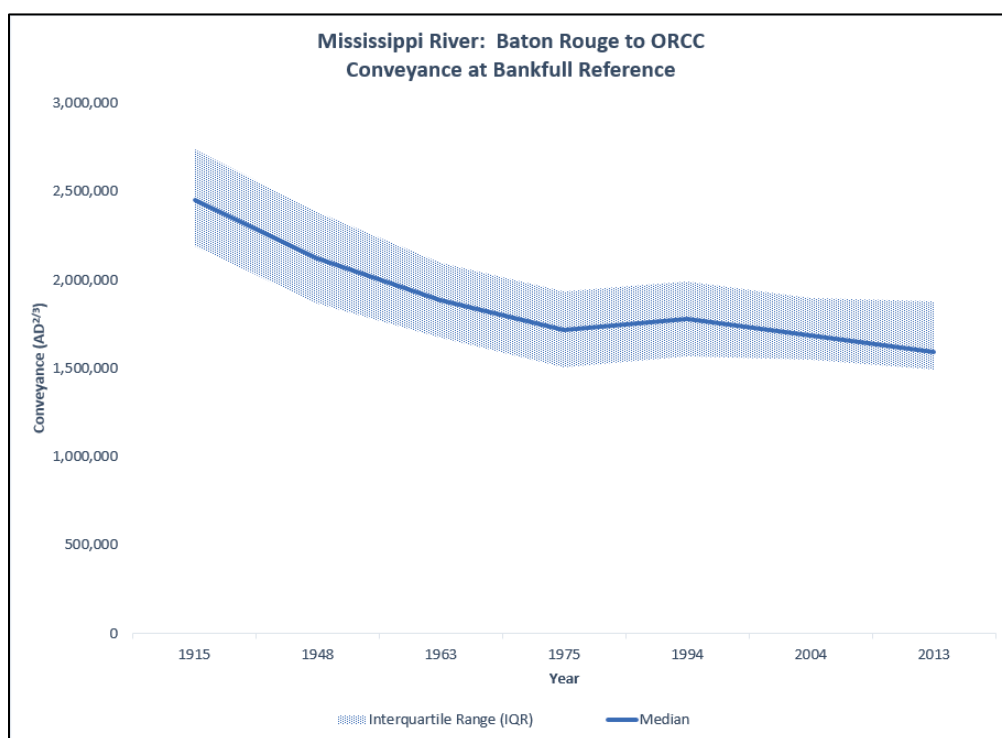


Figure 53. Mississippi River ORCC to Natchez, trend plot of conveyance at bankfull reference.

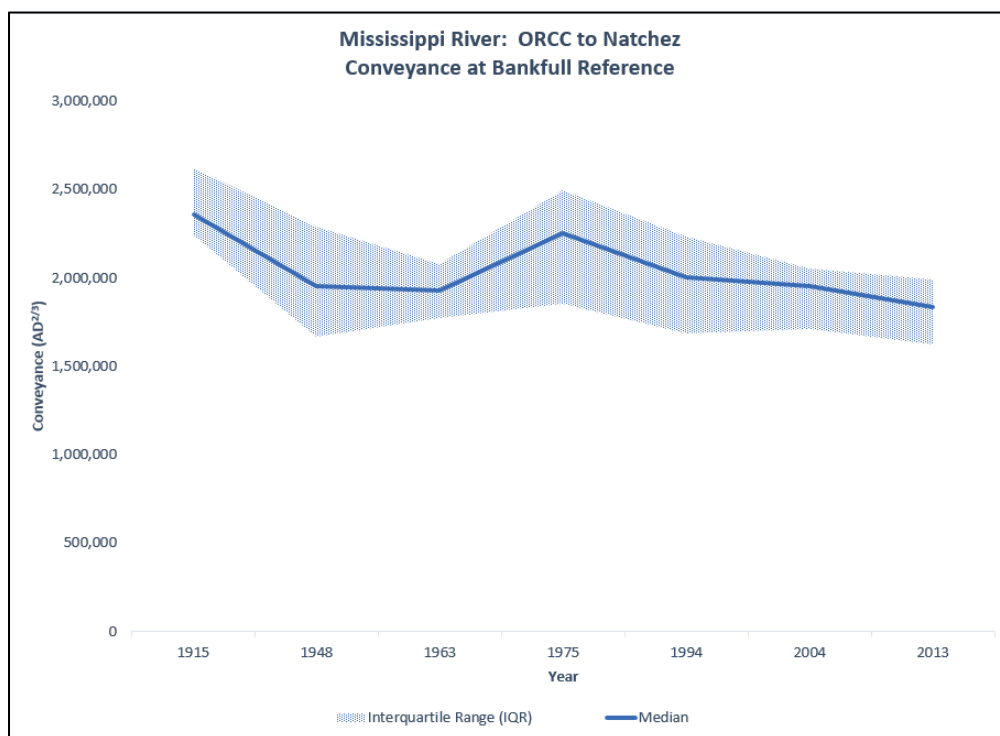
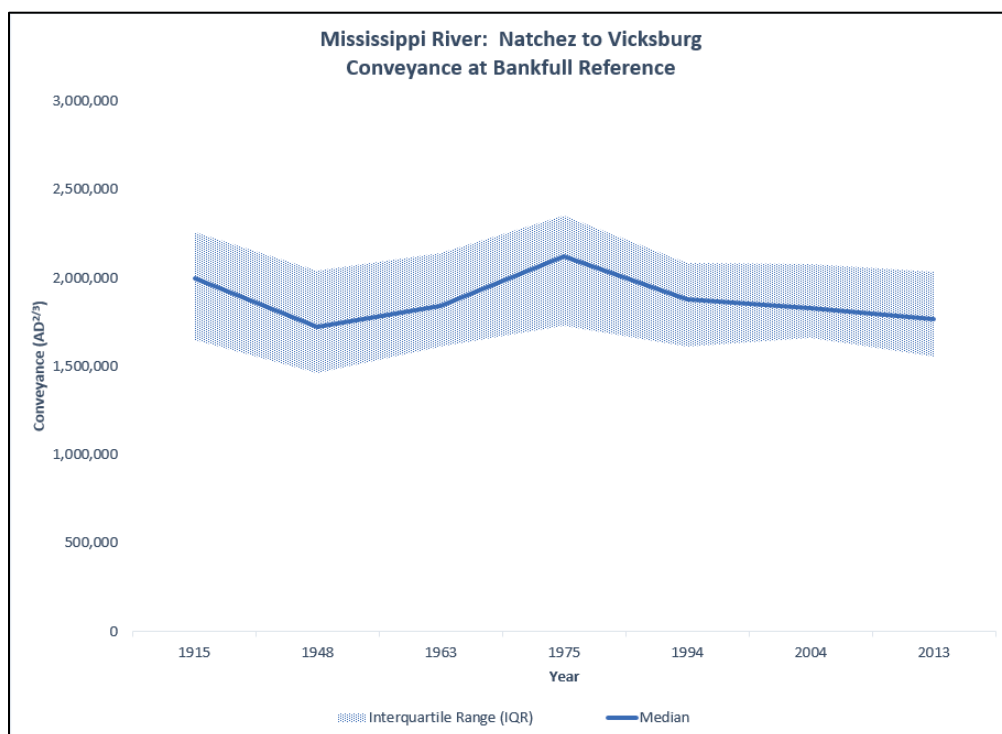


Figure 54. Mississippi River Natchez to Vicksburg, trend plot of conveyance at bankfull reference.



3.1.5 Width/Depth (W/D) ratio–Mississippi River

The W/D ratio is generally defined as the ratio of the bankfull channel width to the mean channel depth at bankfull condition. The W/D ratio is often used to describe channel cross-section shape, where large ratios indicate wide and shallow channels similar to the Lower Mississippi River, and lower value ratios may indicate narrow, incised channels. The box-and-whisker plots of W/D ratio at low water reference for the three Mississippi River geomorphic reaches are shown in Figures 55 through 57, and the trend plots for the reaches are shown in Figures 58 through 60. Although there is some variability in the values, the W/D ratio has remained fairly stable or exhibited only slight trend over the survey periods. For the Baton Rouge-to-ORCC reach shown in Figure 55 and Figure 58, the median ratio value increased from 1915 to 1975, decreased sharply from 1975 to 1988, followed by a sharp increase from 1988 to 1994, and a slight increase from 1994 to 2013. With the exception of an increased in median value from 1915 to 1948, the W/D ratio for the ORCC-to-Natchez reach has remained very consistent, as shown in Figure 56 and Figure 59. Figure 57 and Figure 60 show variation in the median ratio value for the Natchez-to-Vicksburg reach. In general, the median ratio increased over the period 1915 to 1988 and then decreased slightly from 1988 to 2013.

Figure 55. Mississippi River Baton Rouge to ORCC, W/D ratio at low water reference.

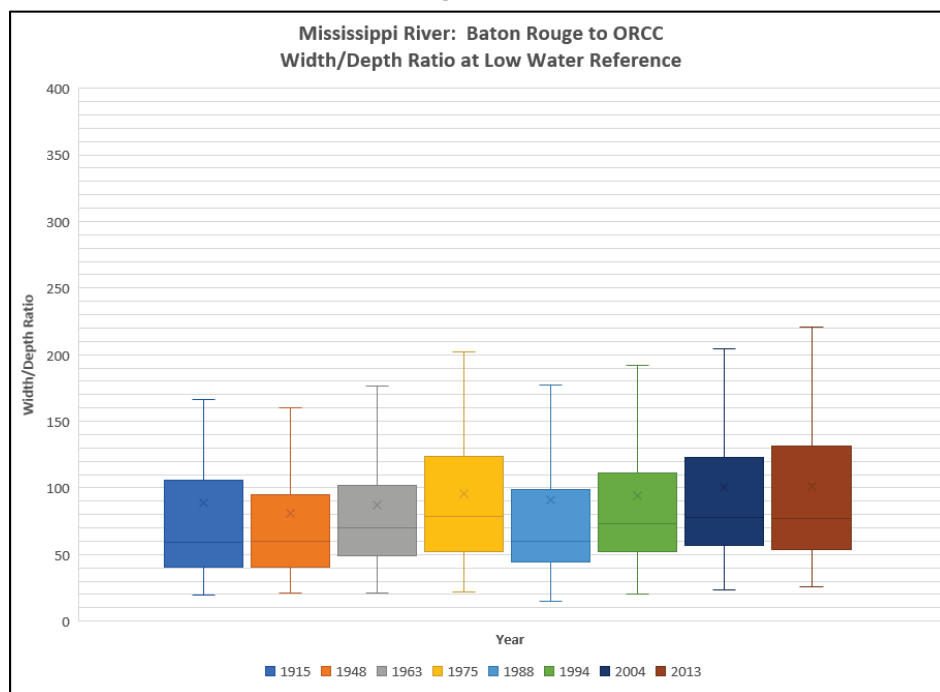


Figure 56. Mississippi River ORCC to Natchez, W/D ratio at low water reference.

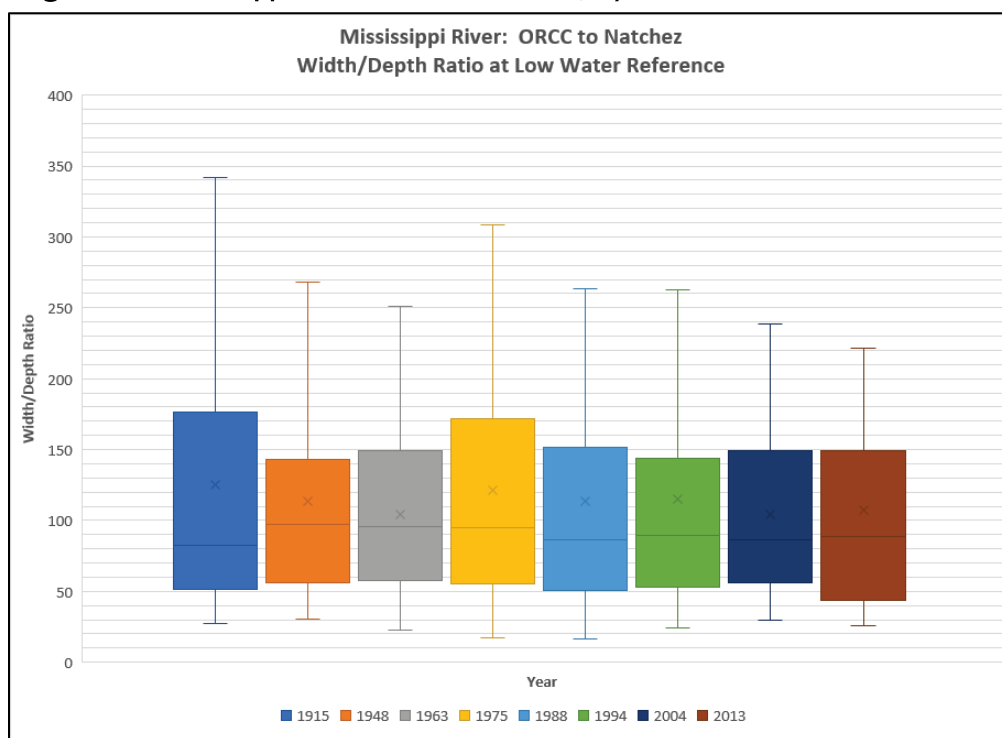


Figure 57. Mississippi River Natchez to Vicksburg, W/D ratio at low water reference.

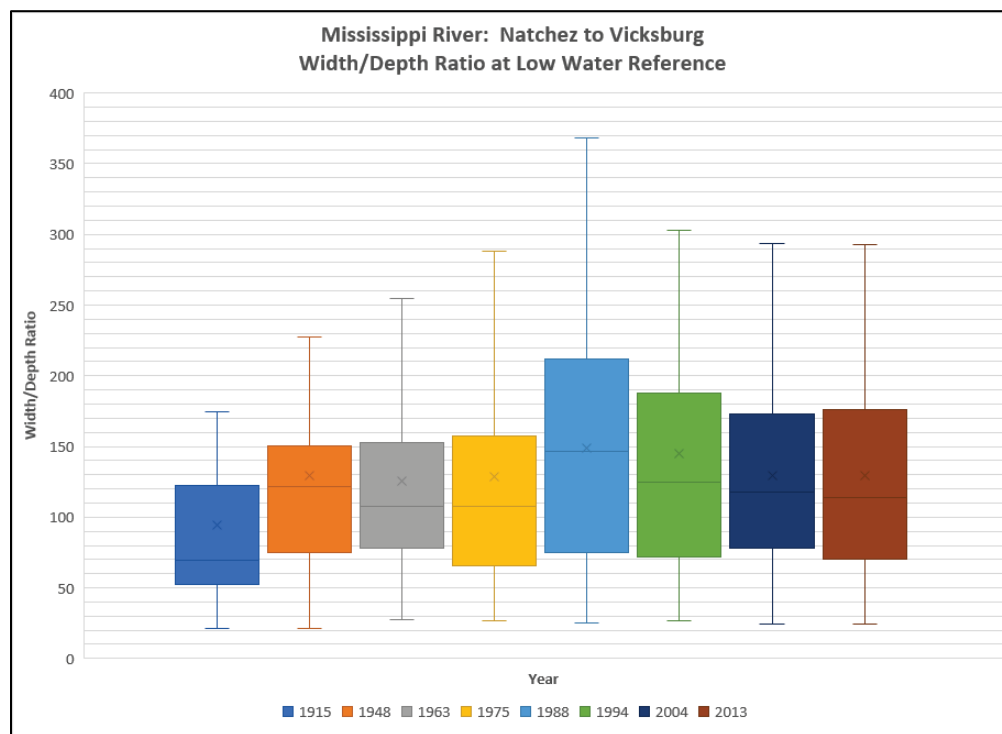


Figure 58. Mississippi River Baton Rouge to ORCC, trend plot of W/D ratio at low water reference.

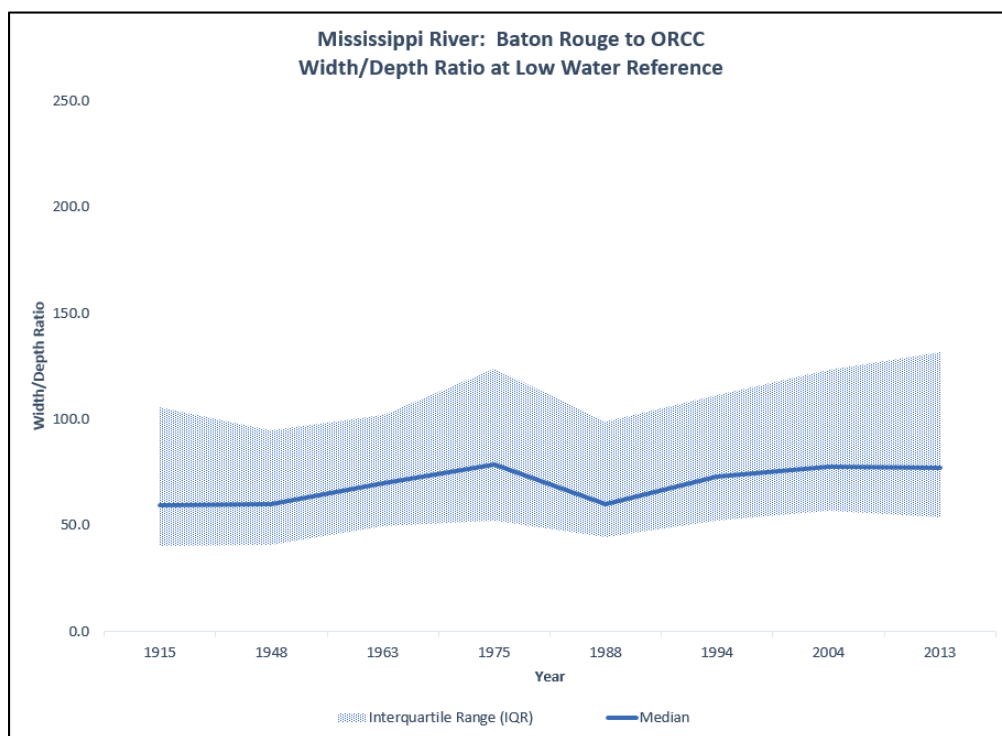


Figure 59. Mississippi River ORCC to Natchez, trend plot of W/D ratio at low water reference.

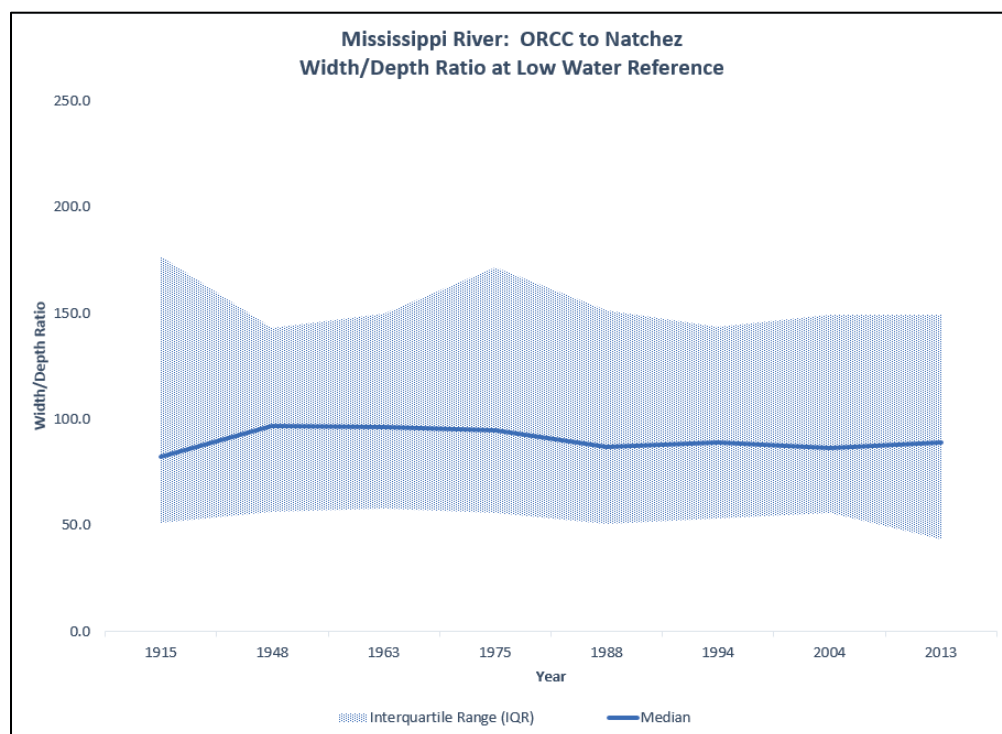
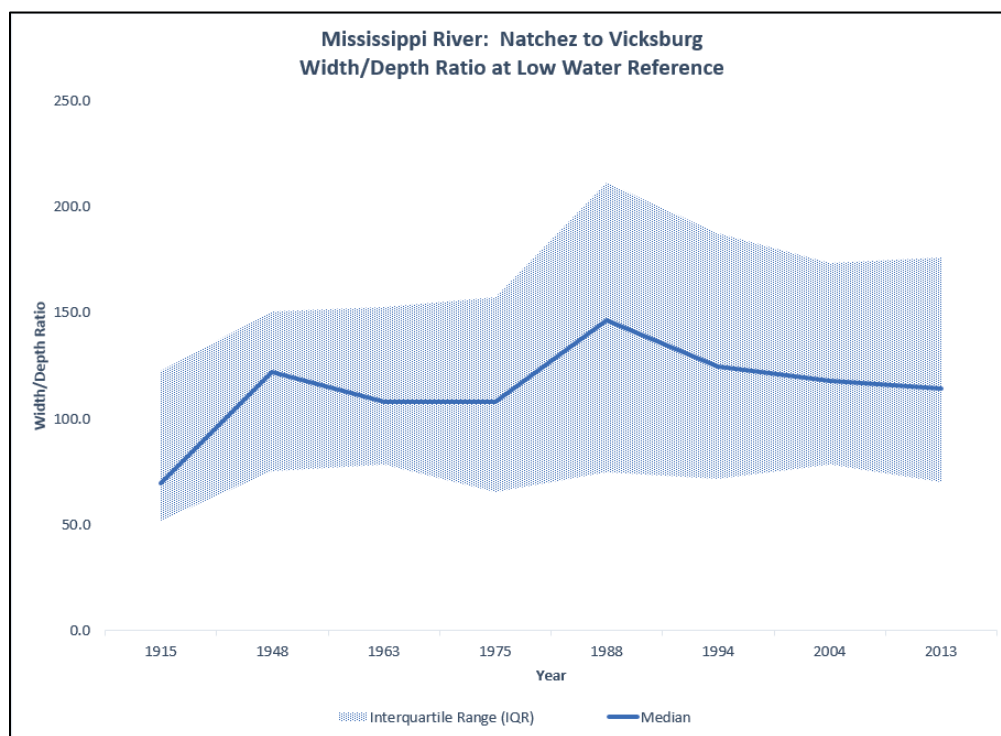


Figure 60. Mississippi River Natchez to Vicksburg, trend plot of W/D ratio at low water reference.



The box-and-whisker plots of W/D ratio referenced to bankfull for the Mississippi River geomorphic reaches are presented in Figures 61 through 63, and the trend plots of W/D ratio are presented in Figures 64 through 66. In general, the plots indicate similar trends in bankfull W/D as those referenced to low water. The plots for all reaches indicate sharp reductions in median W/D ratio in the survey period 1975, but the values rebound to previous levels by the next survey period. For the Baton Rouge-to-ORCC reach shown in Figure 61 and Figure 64, the median value of W/D ratio increases slightly from 1948 to 2013. Figure 62 and Figure 65 indicate a trend for the ORCC to Natchez reach, with the 1975 survey potentially reflecting temporary changes to the channel from the 1973 flood. Figure 63 and Figure 66 indicate a similar trend for the Natchez-to-Vicksburg reach as was observed for the ORCC to Natchez reach.

Figure 61. Mississippi River Baton Rouge to ORCC, W/D ratio at bankfull reference.

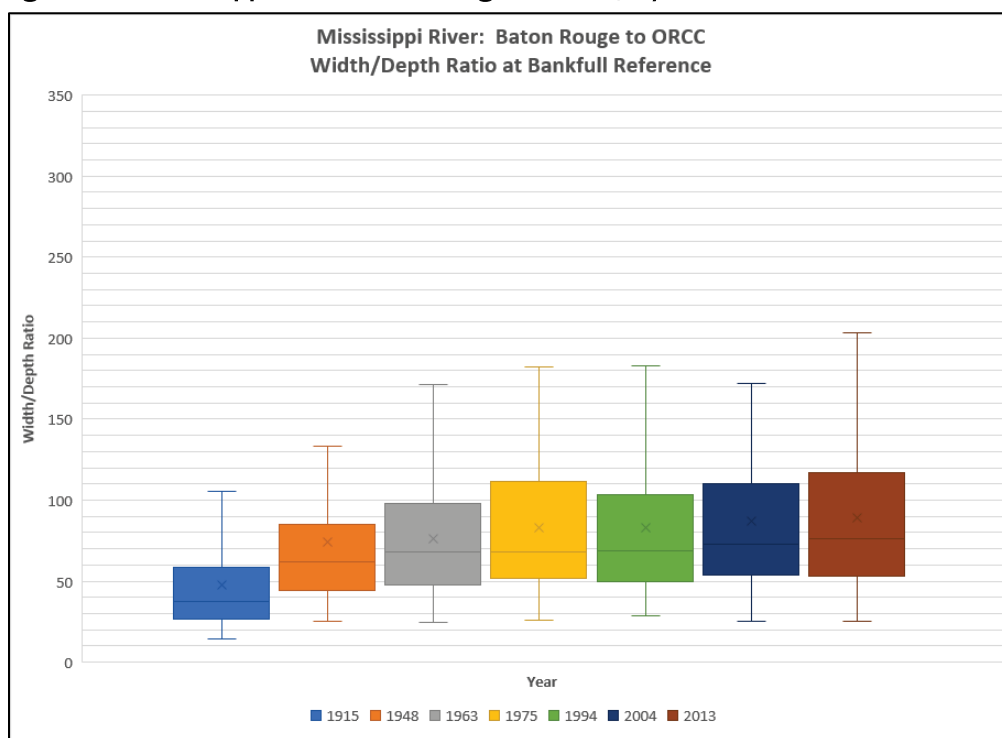


Figure 62. Mississippi River ORCC to Natchez, W/D ratio at bankfull reference.

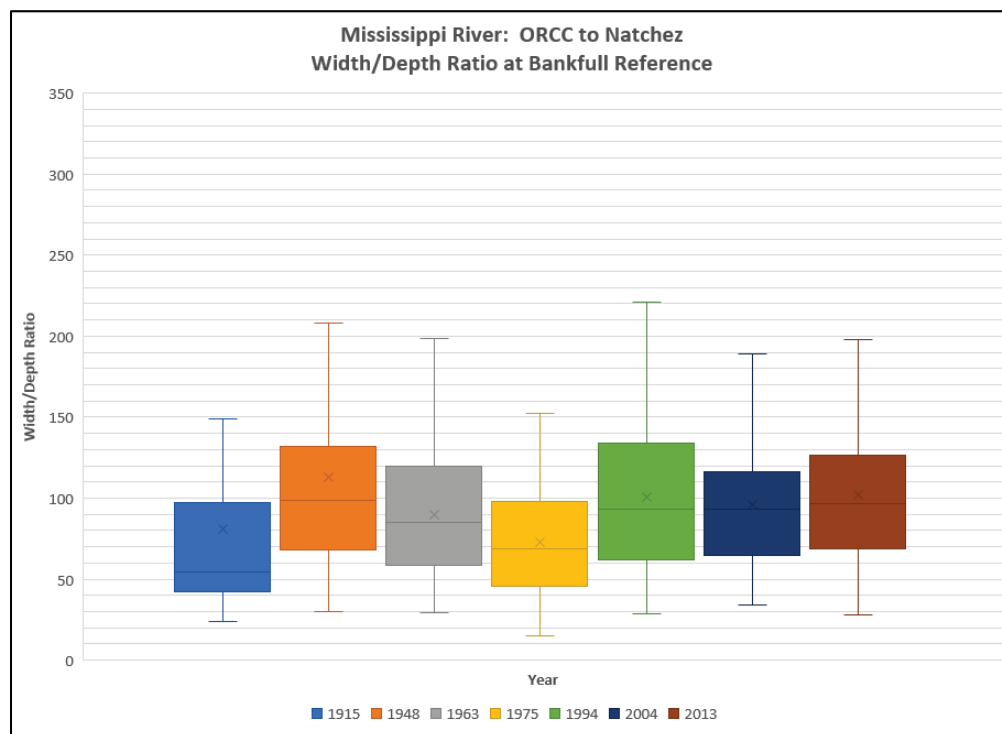


Figure 63. Mississippi River Natchez to Vicksburg, W/D ratio at bankfull reference.

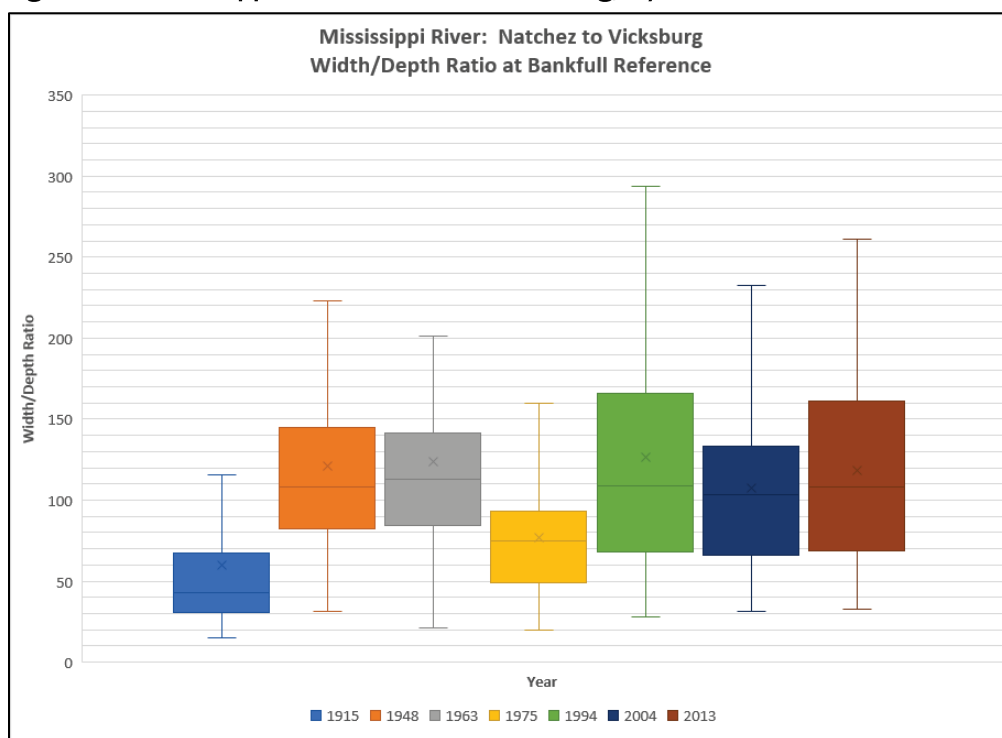


Figure 64. Mississippi River Baton Rouge to ORCC, trend plot of W/D ratio at bankfull reference.

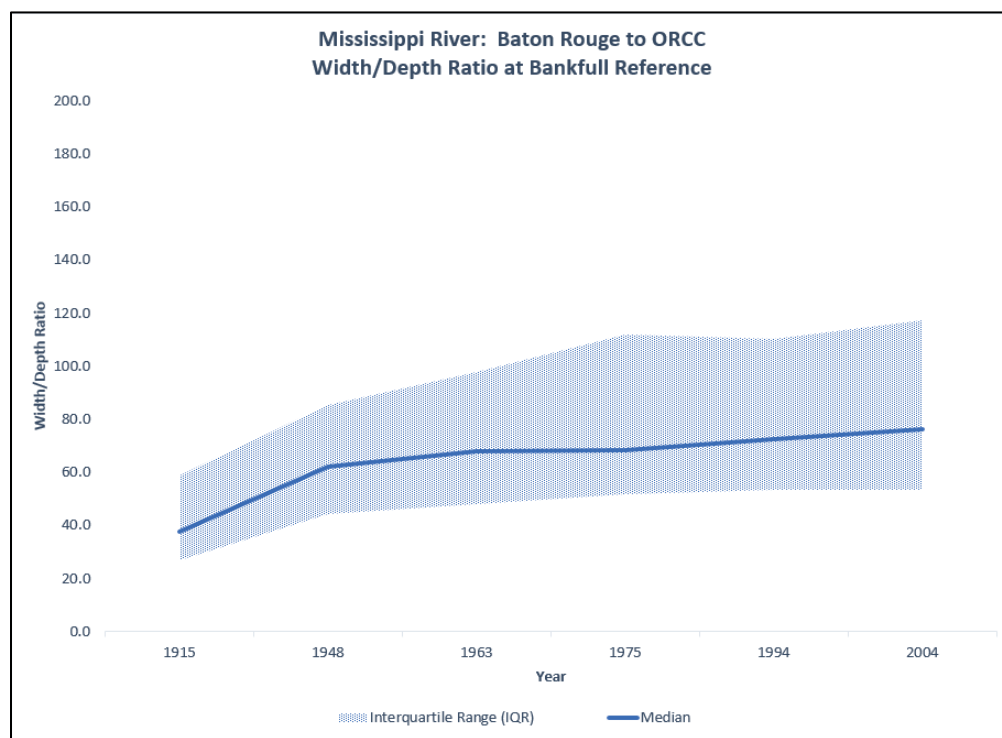


Figure 65. Mississippi River ORCC to Natchez, trend plot of W/D ratio at bankfull reference.

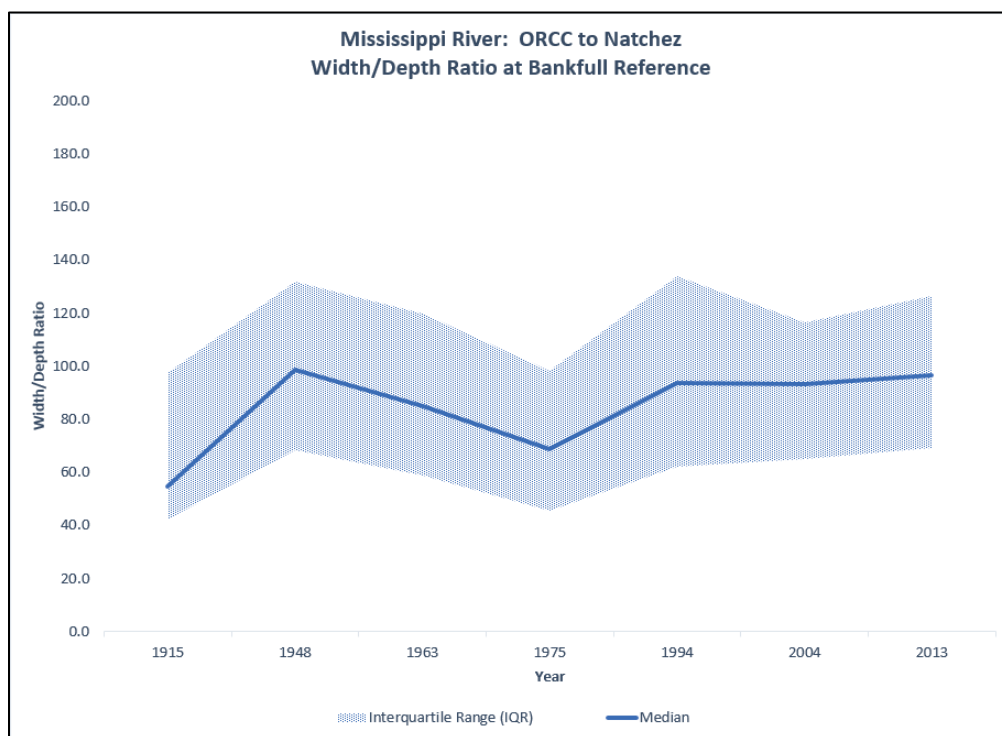
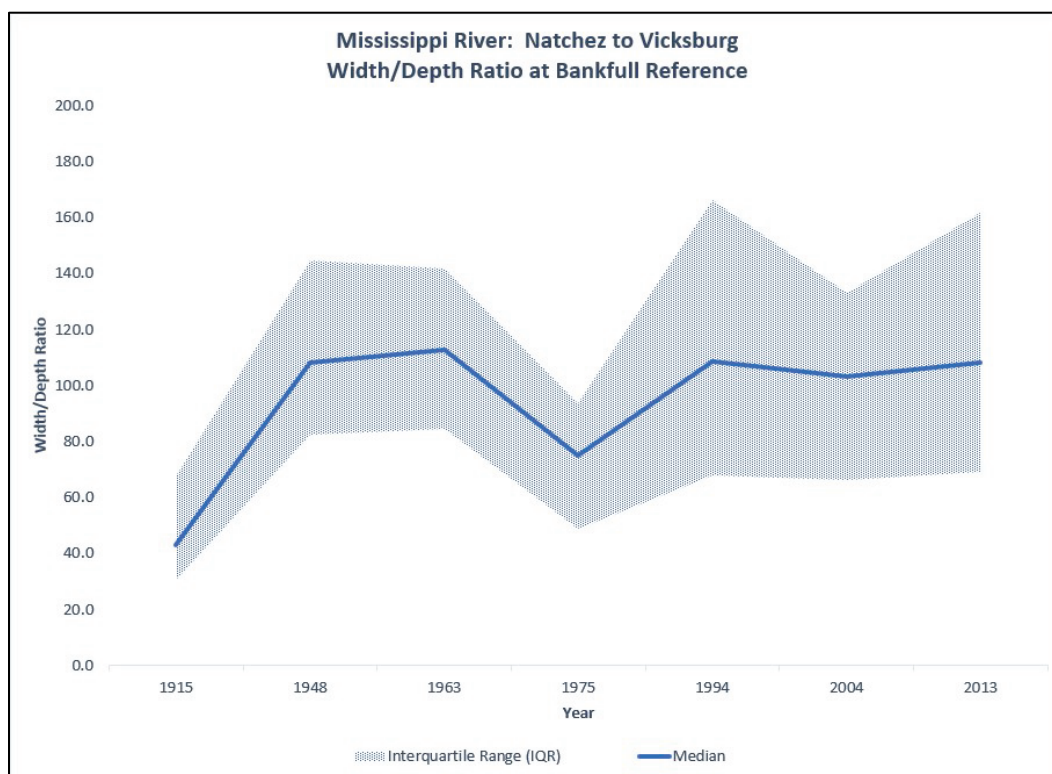


Figure 66. Mississippi River Natchez to Vicksburg, trend plot of W/D ratio at bankfull reference.



3.2 Geometric parameter analyses–Atchafalaya River

A similar geometric parameter analysis was conducted for the Atchafalaya River as was conducted for the Mississippi River. A comprehensive tabulation of the cross-section area, width, hydraulic depth, computed conveyance, and W/D ratio for all individual cross sections of the Atchafalaya River geomorphic reaches is presented in Appendix B. The statistical analysis results and box-and-whisker plots for each geometric parameter for the Atchafalaya River are presented in the following sections.

3.2.1 Cross-sectional area–Atchafalaya River

Box-and-whisker plots of the computed cross-section area referenced to the LWRP for the Atchafalaya River geomorphic reaches are shown in Figures 67 through 69. The trend plots of cross-sectional area for the reaches are shown in Figures 70 through 72. For the reach from Old River (River Mile [RM] 0) to the head of Whiskey Bay Pilot Channel (WBPC, RM 56), Figure 67 and Figure 70 indicate a slight decreasing trend in median cross-sectional area from 1976 to 1998, followed by a slightly increasing trend in area from 1998 to 2019. Over the entire time period of the surveys, there is very little change in area with slight fluctuation.

Figures 68 and 71 for the reach from the head of WBPC to Grand Lake (RM 101) indicate a continual increase in median cross-sectional area for the survey time periods. The greatest increase occurs from 1976 to 1989, and a steady increase occurs from 1976 to 2019. This may be a result of continuing development of the WBPC through either channel degradation or widening.

Figures 69 and 72 show the median cross-sectional area for the Grand Lake-to-Morgan City, LA (RM 121), reach increases slightly from 1976 to 1989 then slowly decreases steadily from 1989 to 2019. The decrease in area may be from deposition related to erosion from the WPBC over the same time period. Note that the IQR widens from 1989 to 2019, indicating an increasingly broader distribution of the central 50% of the data over the time period. Also note that this reach is subject to tidal influence as well as periodic maintenance dredging activities.

Figure 67. Atchafalaya River Old River to WBPC, cross-sectional area at low water reference.

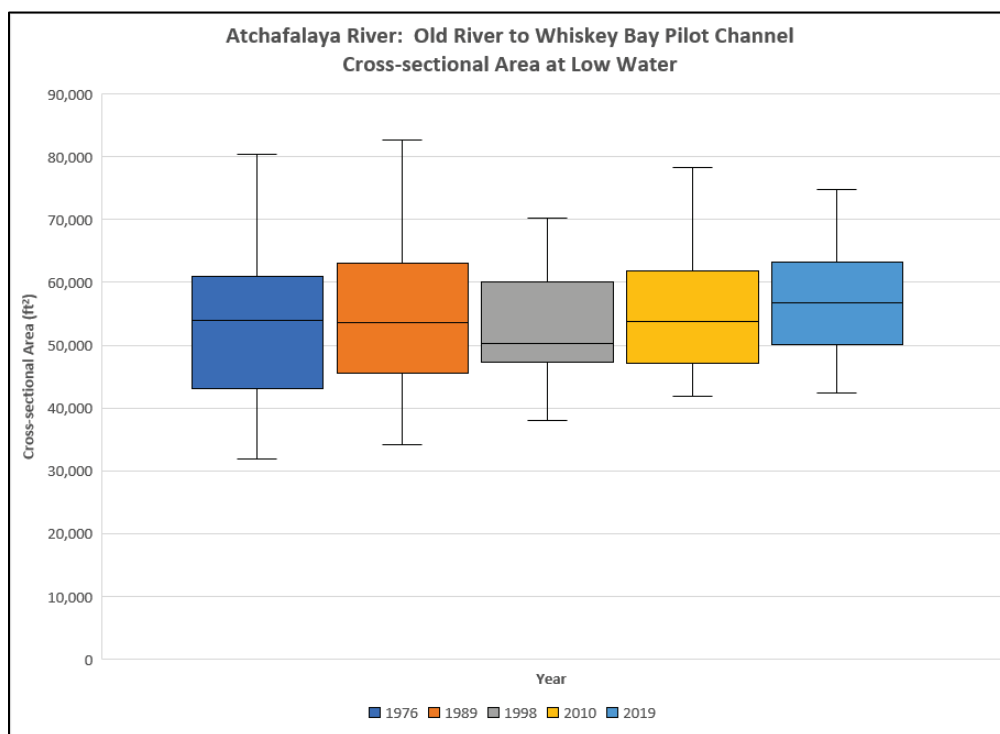


Figure 68. Atchafalaya River WBPC to Grand Lake, cross-sectional area at low water reference.

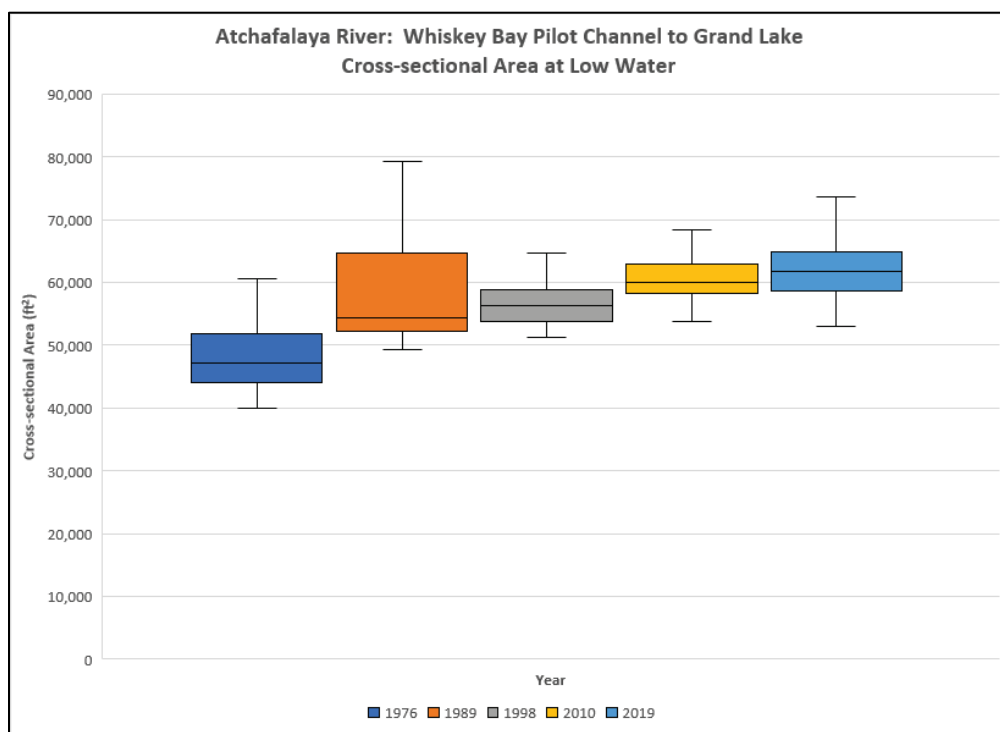


Figure 69. Atchafalaya River Grand Lake to Morgan City, LA, cross-sectional area at low water reference.

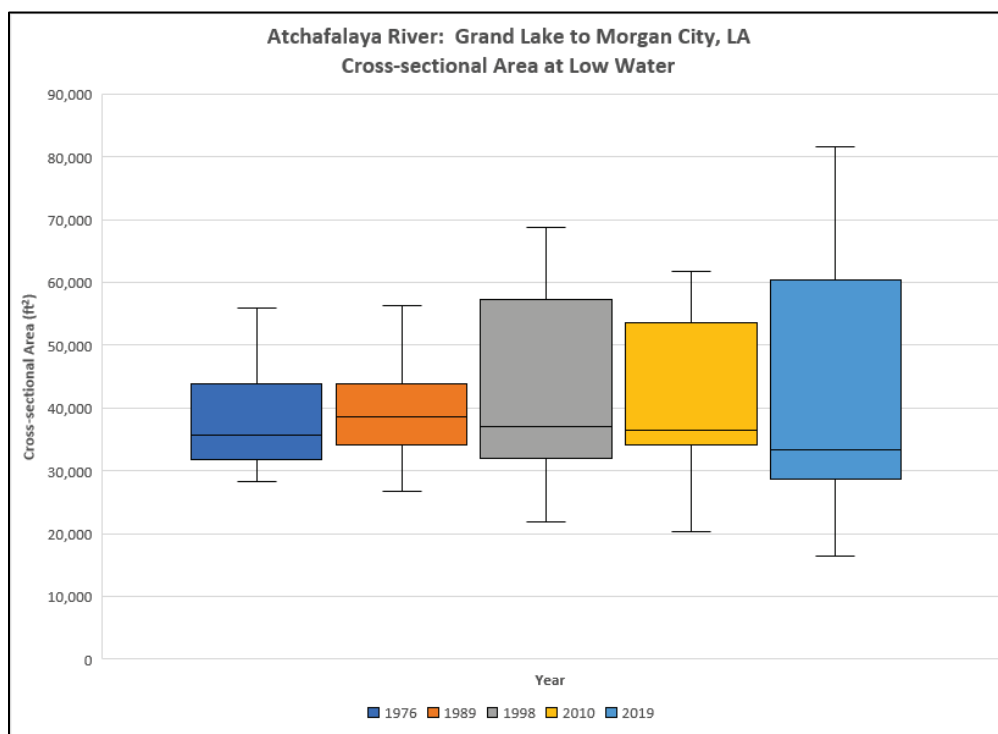


Figure 70. Atchafalaya River Old River to WBPC, trend plot of cross-sectional area at low water reference.

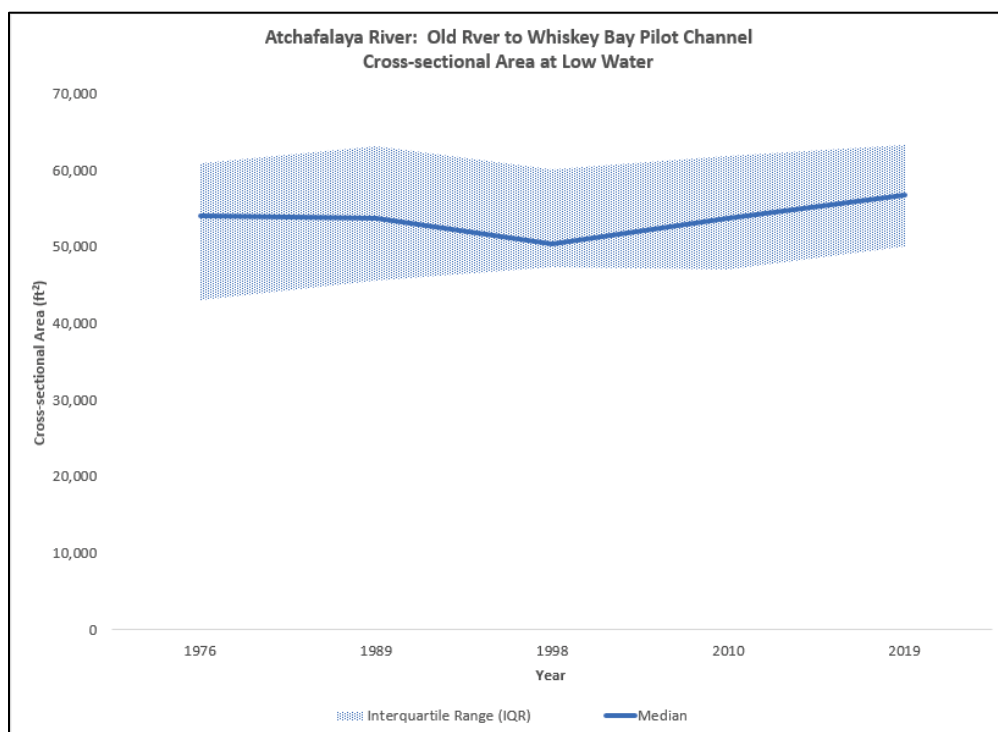


Figure 71. Atchafalaya River WBPC to Grand Lake, trend plot of cross-sectional area at low water reference.

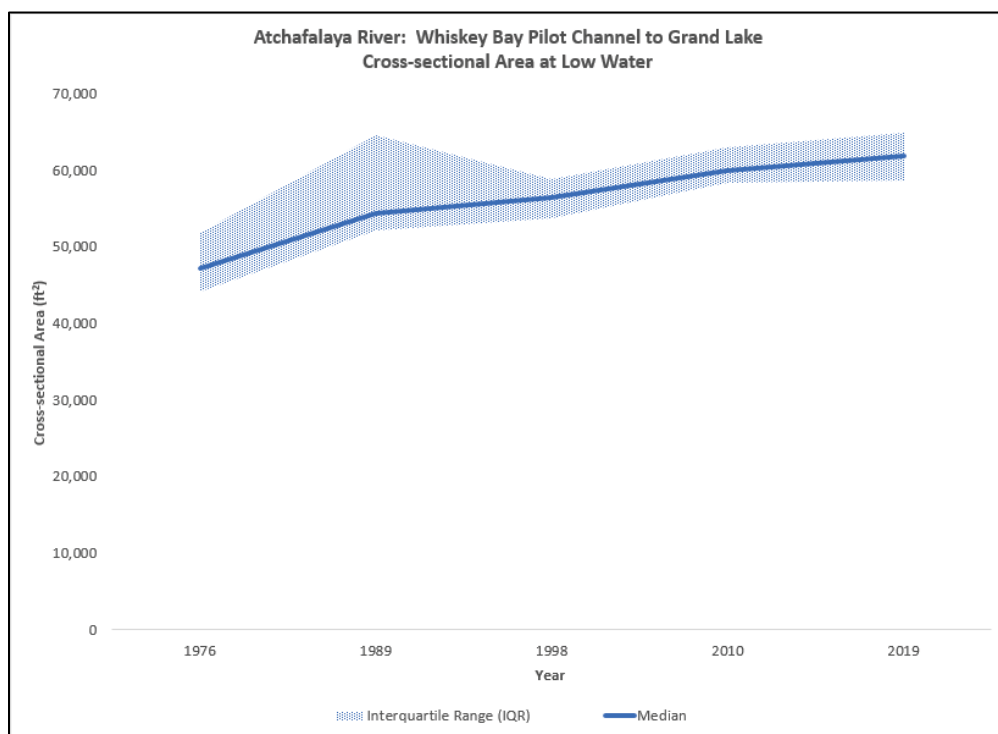
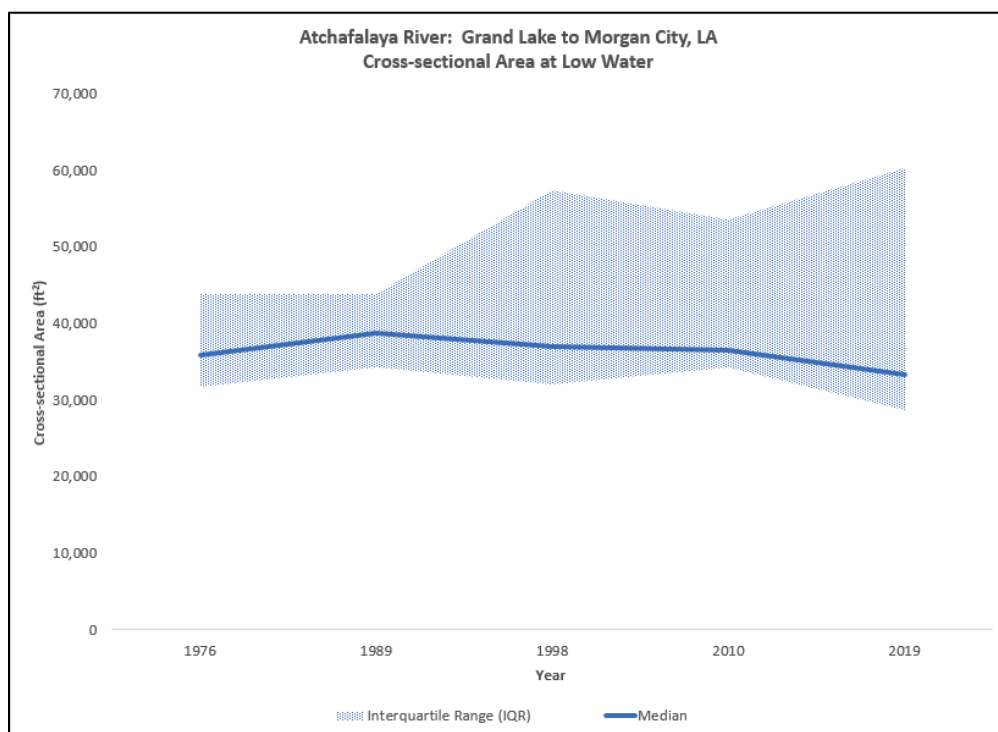


Figure 72. Atchafalaya River Grand Lake to Morgan City, LA, trend plot of cross-sectional area at low water reference.



Box-and-whisker plots of the computed cross-section area referenced to bankfull reference plane for the Atchafalaya River geomorphic reaches are shown in Figures 73 through 75. The trend plots of cross-sectional area for the reaches are shown in Figures 76 through 78. The trends for median cross-sectional area for the bankfull reference level are very similar to those for the low water reference level. There is little change to a slight increase in area for the Old River-to-WBPC reach over the survey time periods, as shown in Figures 73 and 76. Figures 74 and 77 show a similar steady increase in median area for the WBPC-to-Grand Lake reach as seen for the low water referenced data. Figures 75 and 78, again, show the same steady to slightly decreasing trend as indicated in the low water referenced data.

Figure 73. Atchafalaya River Old River to WBPC, cross-sectional area at bankfull reference.

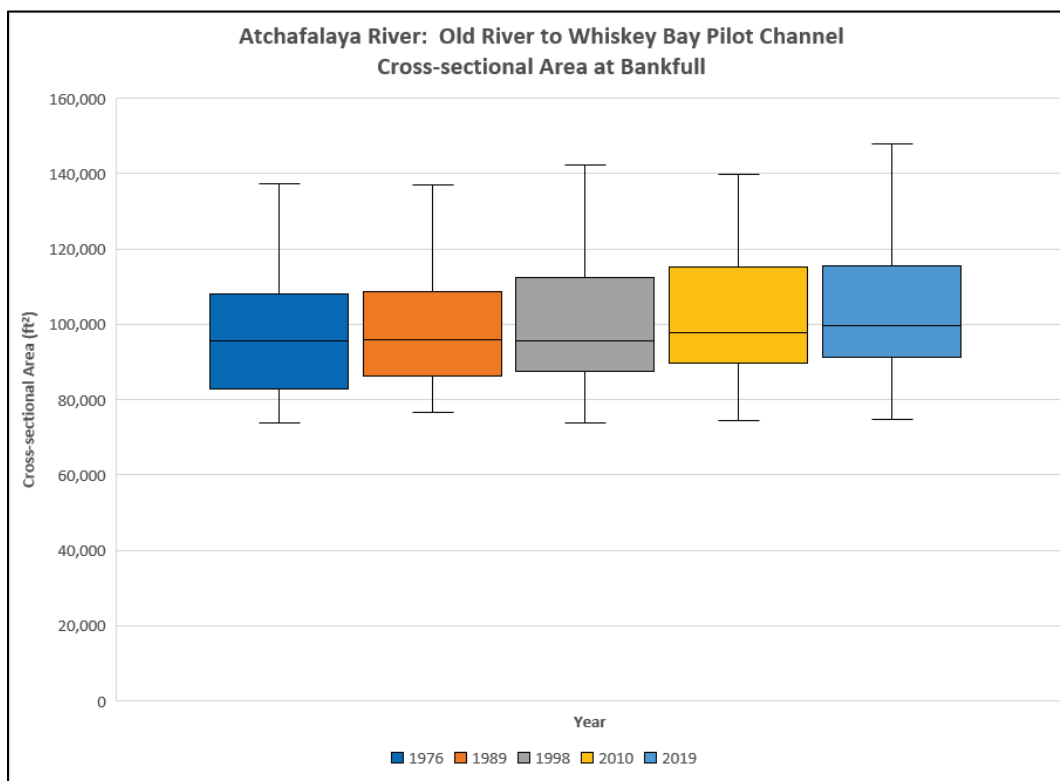


Figure 74. Atchafalaya River WBPC to Grand Lake, cross-sectional area at bankfull reference.

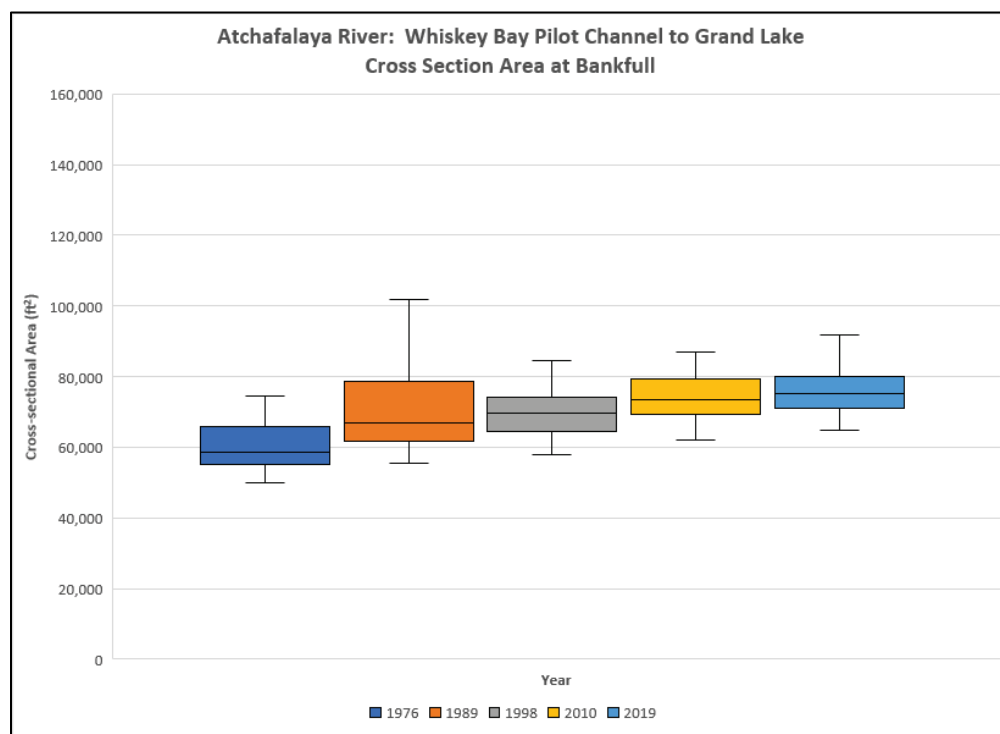


Figure 75. Atchafalaya River Grand Lake to Morgan City cross-sectional area at bankfull reference.

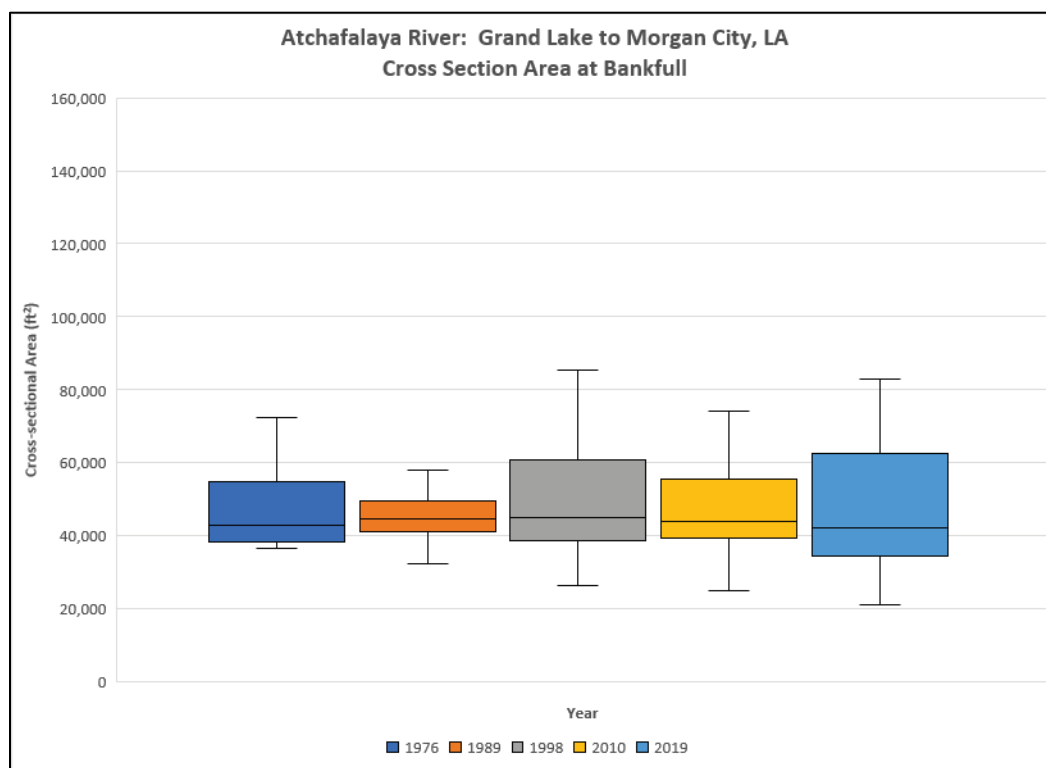


Figure 76. Atchafalaya River Old River to WBPC, trend plot of cross-sectional area at bankfull reference.

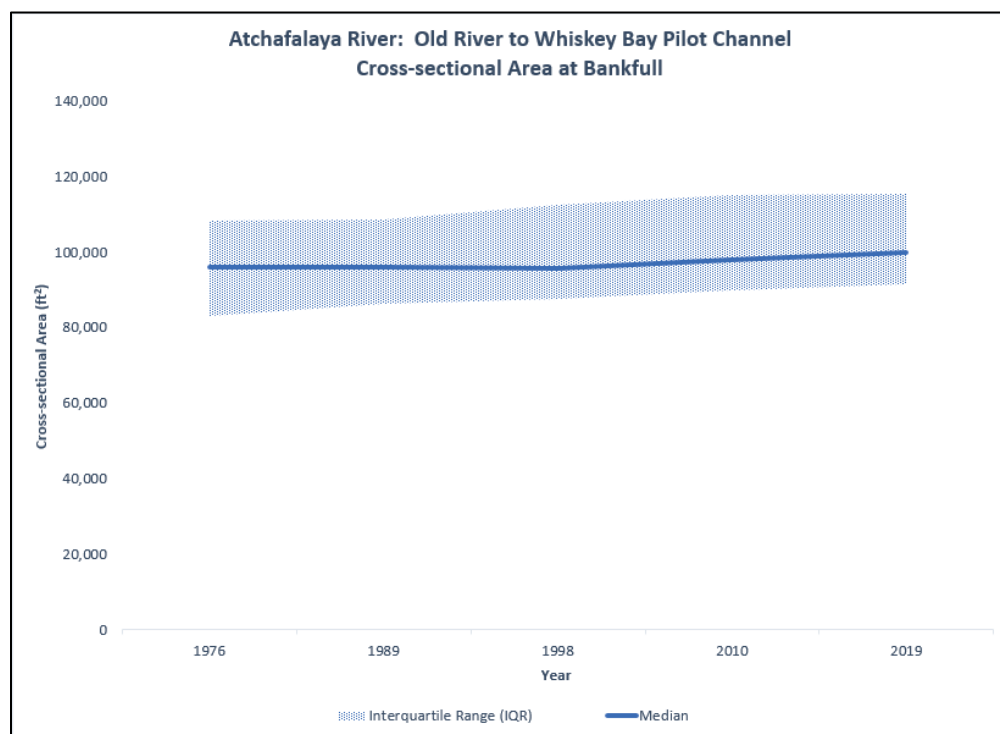


Figure 77. Atchafalaya River WBPC to Grand Lake, trend plot of cross-sectional area at bankfull reference.

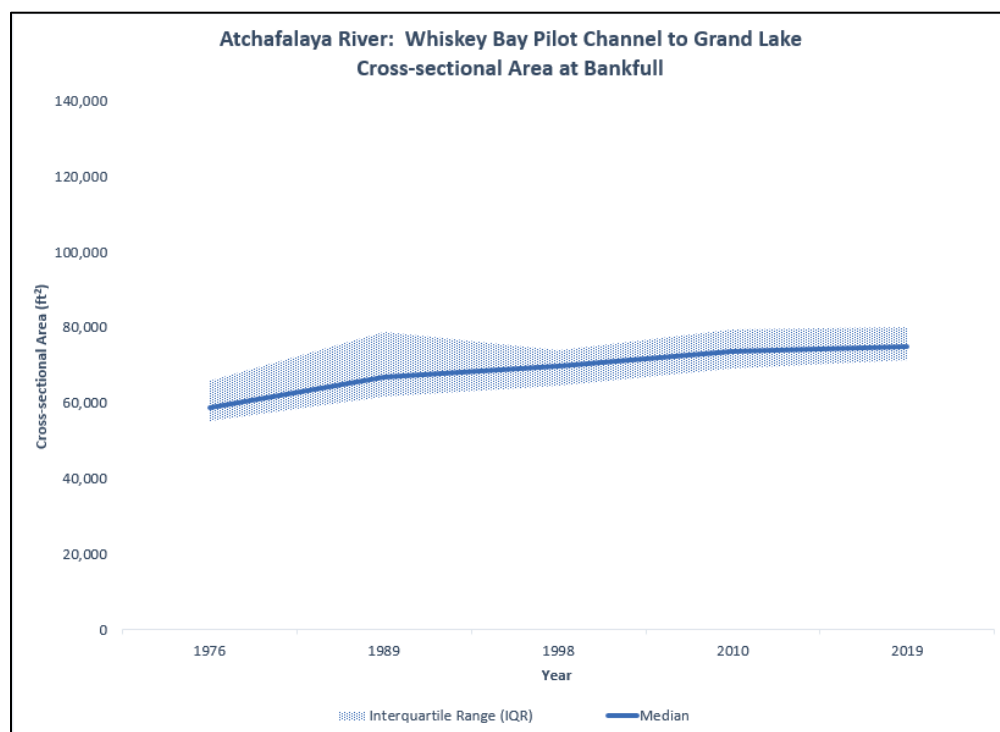
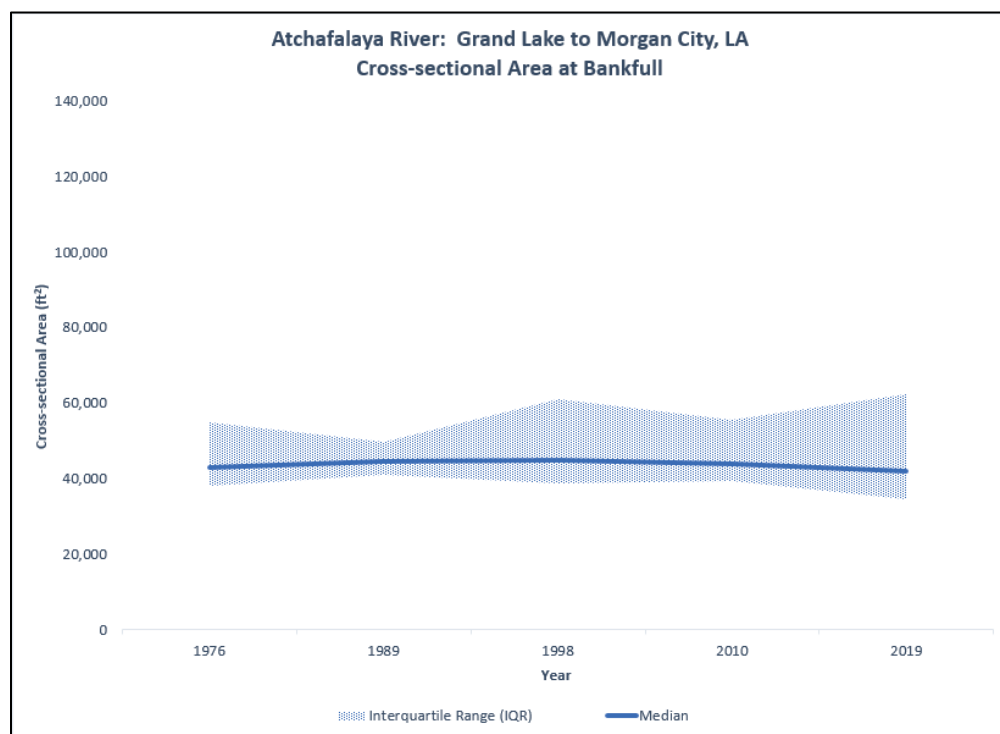


Figure 78. Atchafalaya River Grand Lake to Morgan City, LA, trend plot of cross-sectional area at bankfull reference.



3.2.2 Width–Atchafalaya River

Box-and-whisker plots of the computed channel width referenced to the LWRP for the Atchafalaya River geomorphic reaches are shown in Figures 79 through 81. The trend plots of channel width for the reaches are shown in Figures 82 through 84. In general, the median channel widths at the LWRP for all three reaches shows slight trends to no change. Figures 79 and 82 indicate the median width for the Old River to WBPC reach increases slightly over the 1976 to 2019 survey time period. Figures 80 and 83 indicate similar trends for the WBPC to Grand Lake reach. The median width for the Grand Lake-to-Morgan City, LA, reach, as shown in Figures 81 and 84, shows little change to a slightly decreasing trend over the 1976 to 2019 survey time period. In general, the median channel width for all three reaches has been fairly stable over the survey time periods. Although it is difficult to quantify changes with these data, the changes in width, either increasing or decreasing, are generally less than 10% over the entire survey time periods.

Figure 79. Atchafalaya River Old River to WBPC, channel width at low water reference.

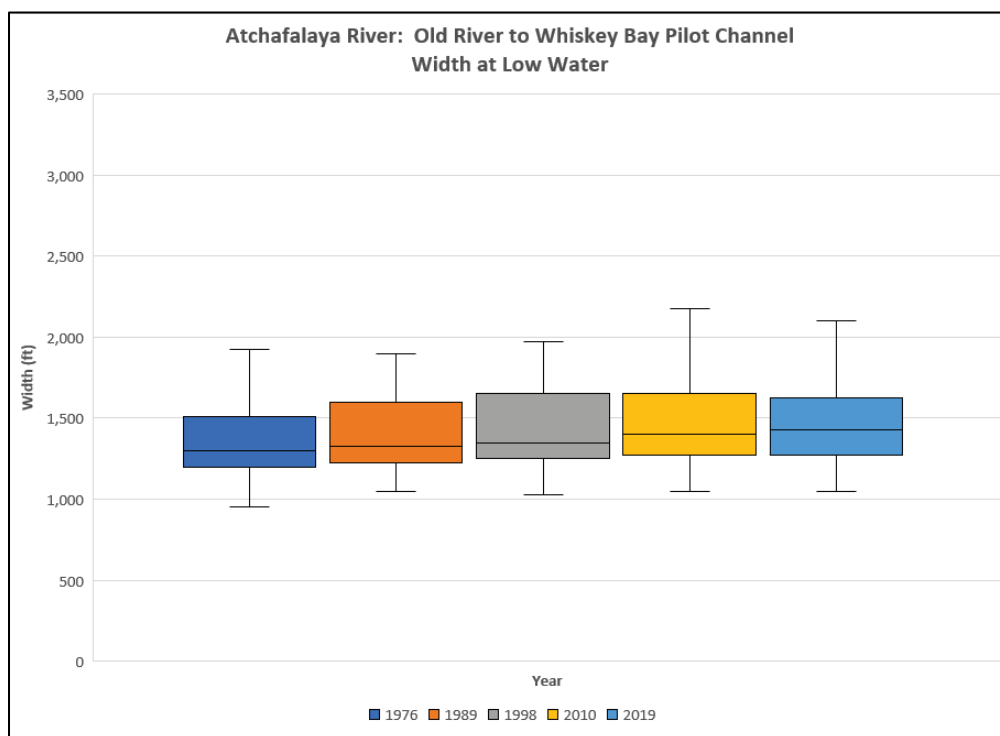


Figure 80. Atchafalaya River WBPC to Grand Lake, channel width at low water reference.

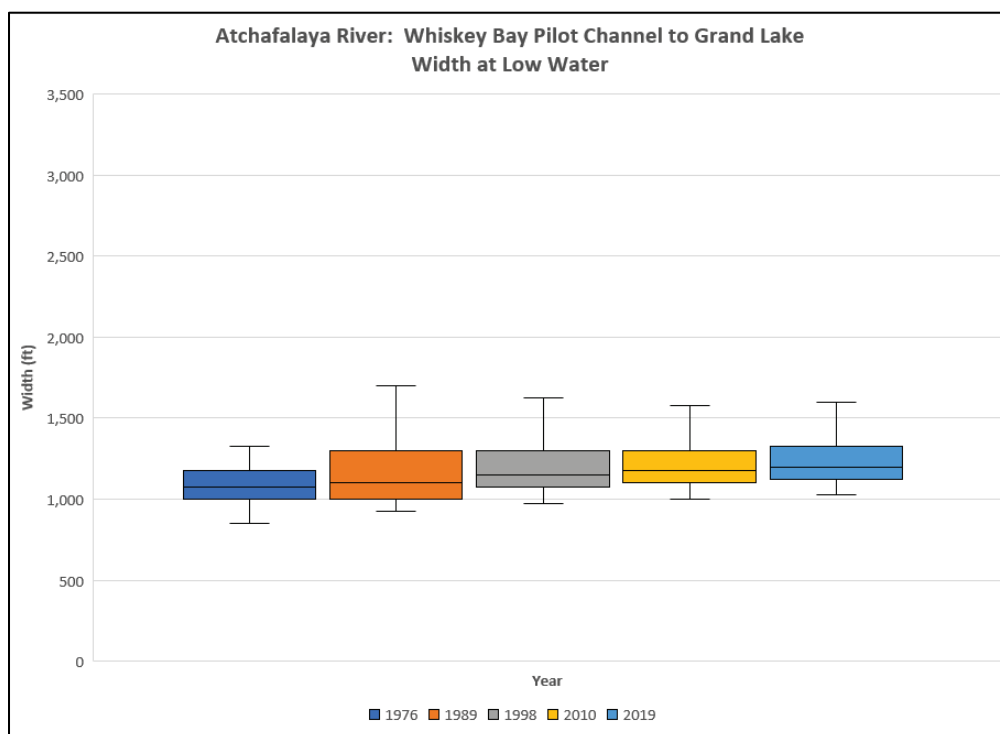


Figure 81. Atchafalaya River Grand Lake to Morgan City, channel width at low water reference.

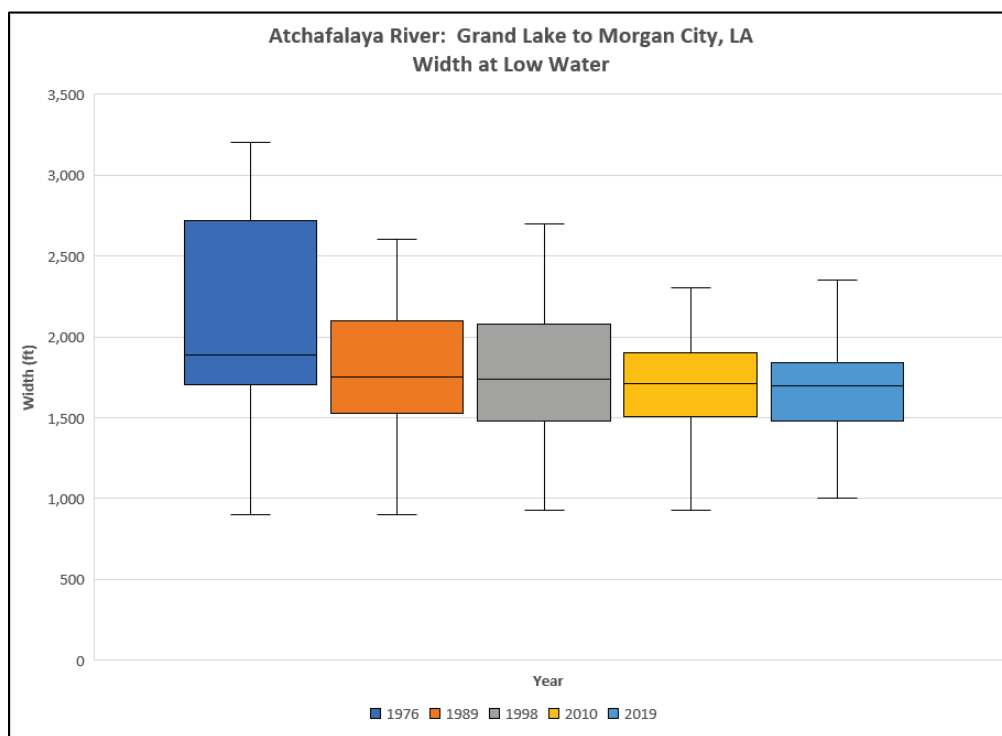


Figure 82. Atchafalaya River Old River to WBPC, trend plot of channel width at low water reference.

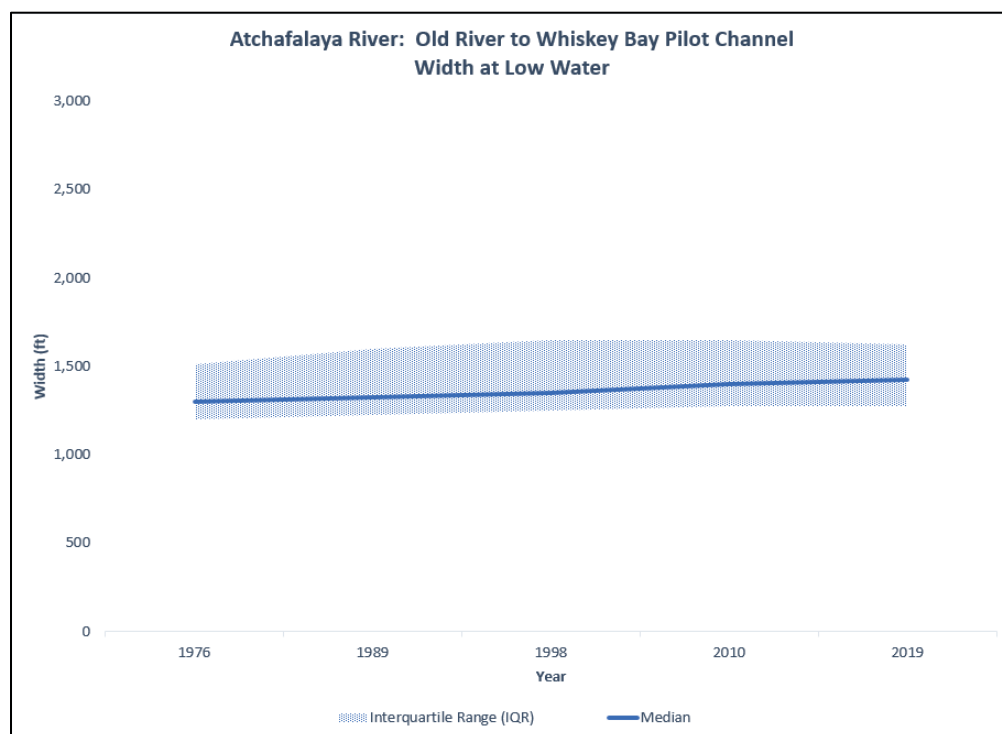


Figure 83. Atchafalaya River WBPC to Grand Lake, trend plot of channel width at low water reference.

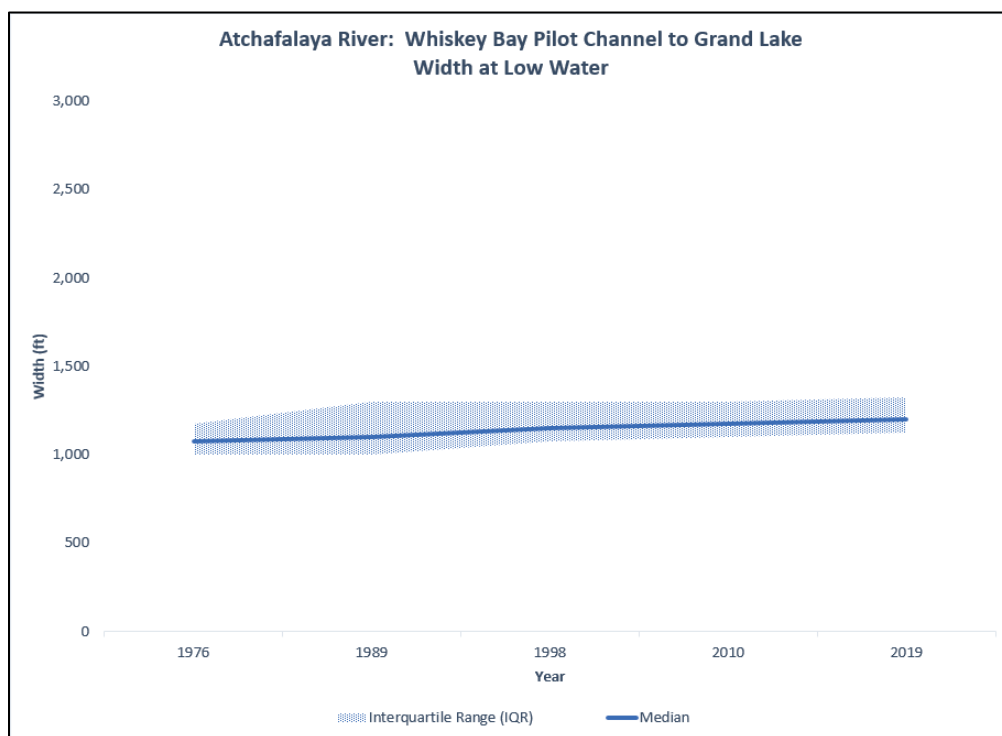
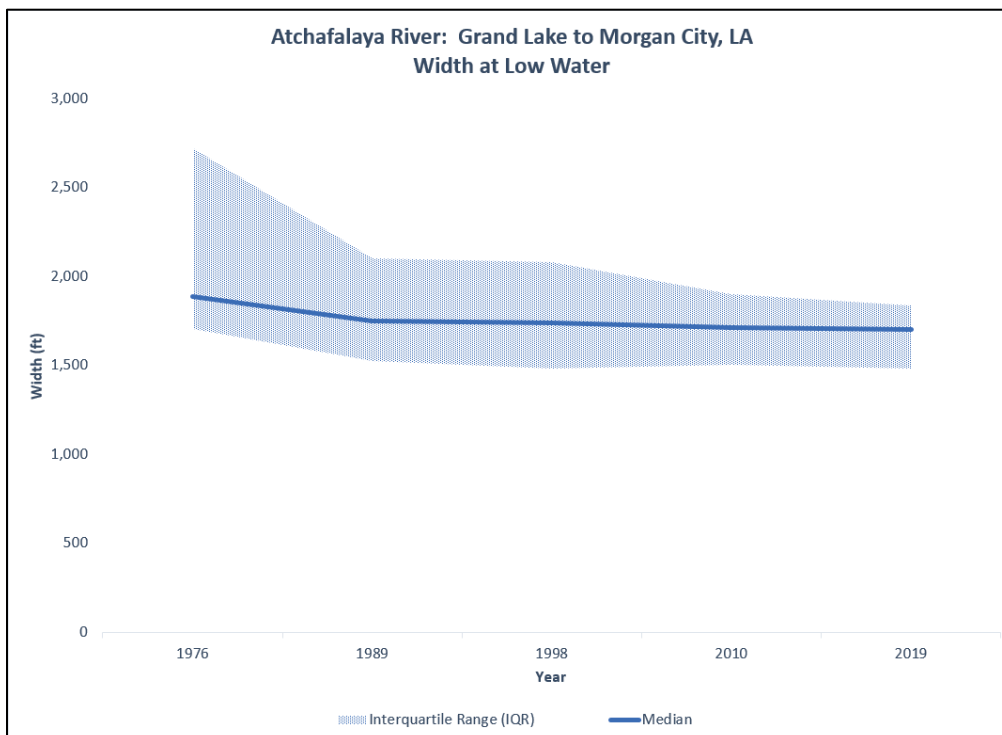


Figure 84. Atchafalaya River Grand Lake to Morgan City, LA, trend plot of channel width at low water reference.



Box-and-whisker plots of the computed channel width referenced to bankfull reference plane for the Atchafalaya River geomorphic reaches are shown in Figures 85 through 87. The trend plots of channel width for the reaches are shown in Figures 88 through 90. In general, the trends in median channel width at bankfull reference are very similar to those for the low water referenced data for all three reaches. There is an increasing trend in median width for the Old River to WBPC reach and the WBPC to Grand Lake reach. For the Grand Lake-to-Morgan City, LA, reach, the trend in median width is generally decreasing.

Figure 85. Atchafalaya River Old River to WBPC, channel width at bankfull reference.

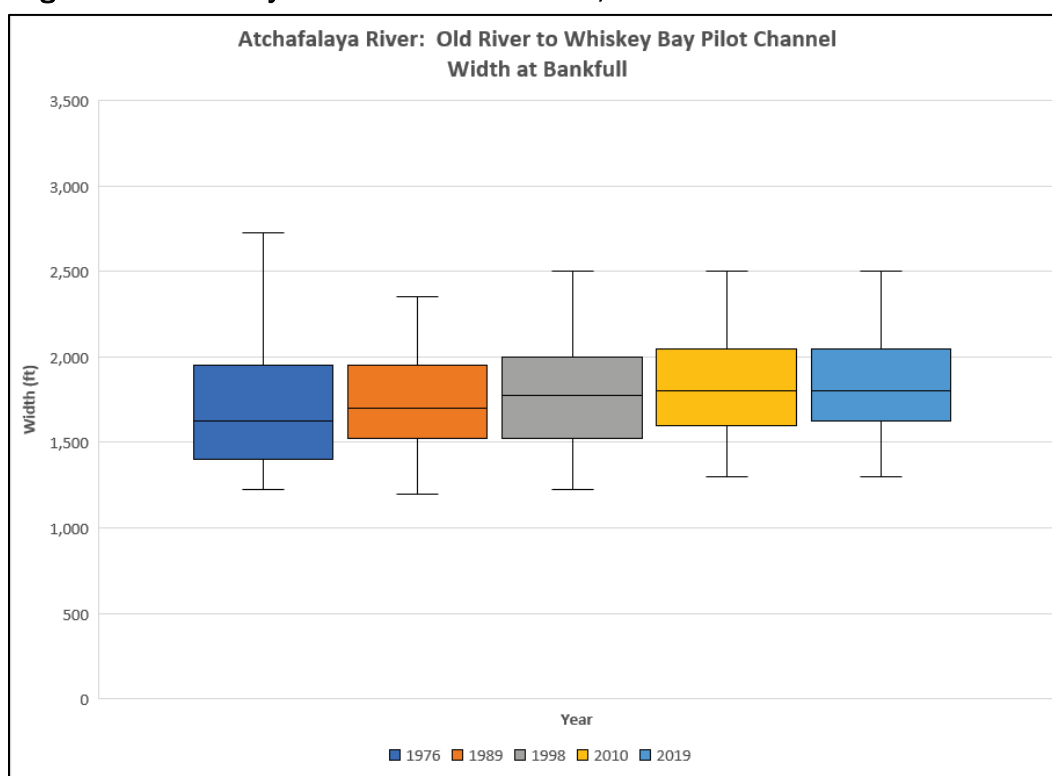


Figure 86. Atchafalaya River WBPC to Grand Lake, channel width at bankfull reference.

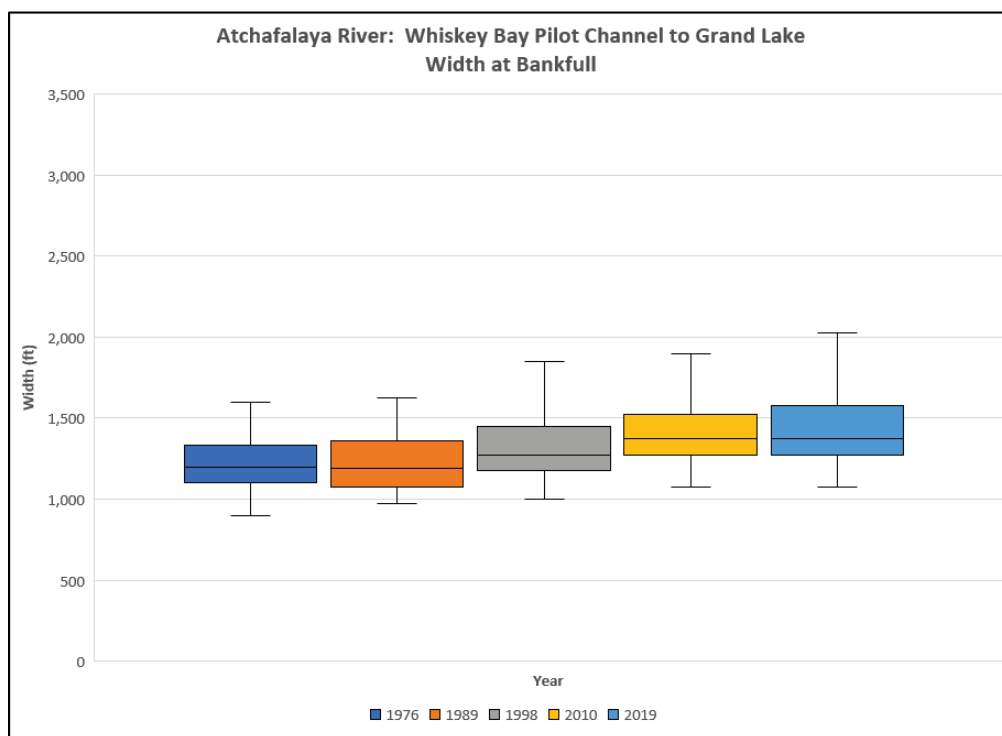


Figure 87. Atchafalaya River Grand Lake to Morgan City, channel width at bankfull reference.

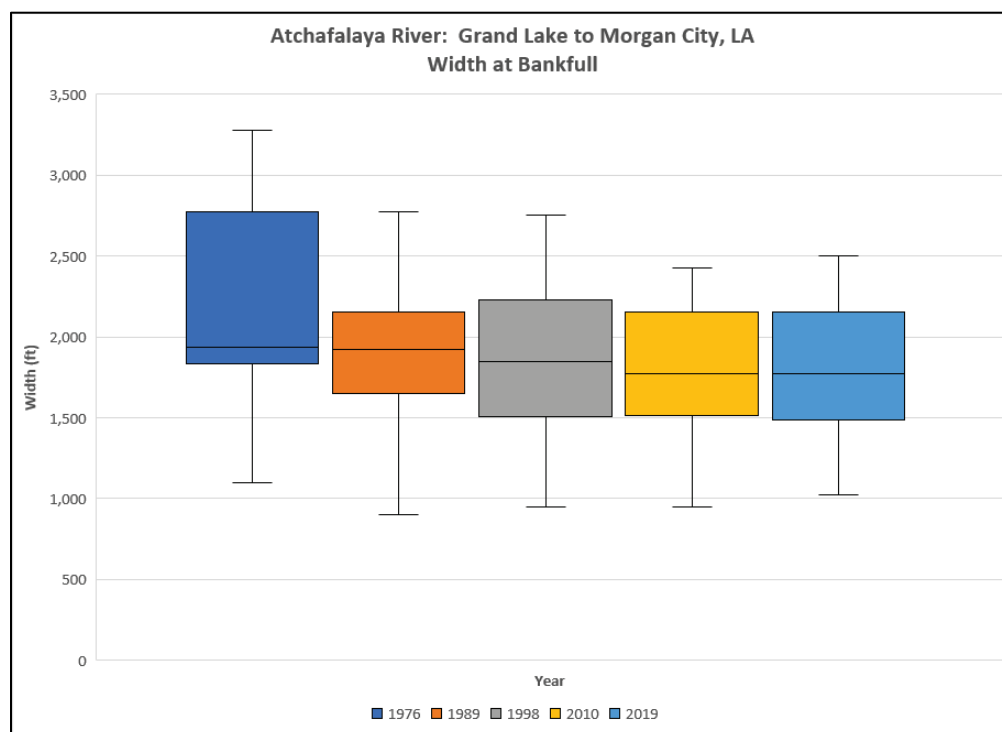


Figure 88. Atchafalaya River Old River to WBPC, trend plot of channel width at bankfull reference.

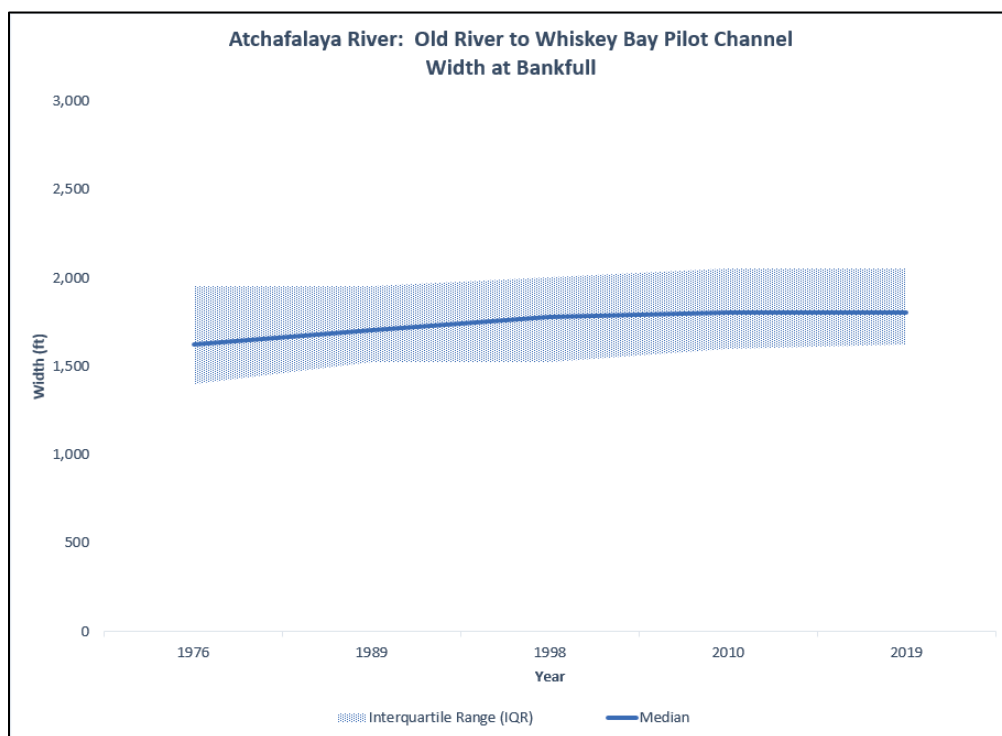


Figure 89. Atchafalaya River WBPC to Grand Lake, trend plot of channel width at bankfull reference.

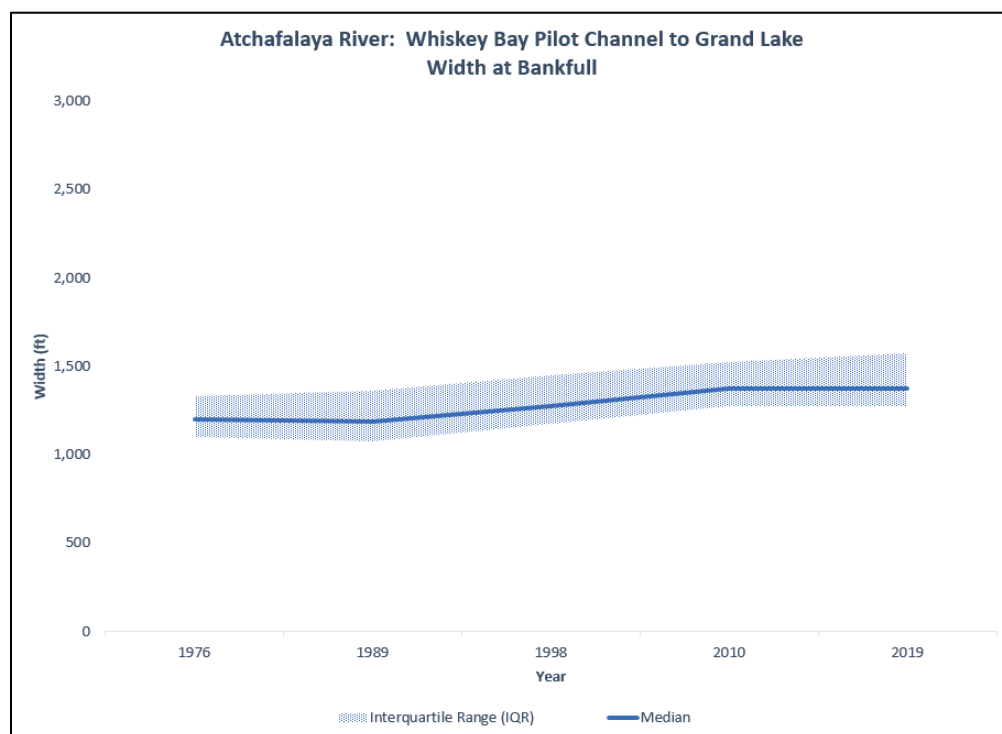
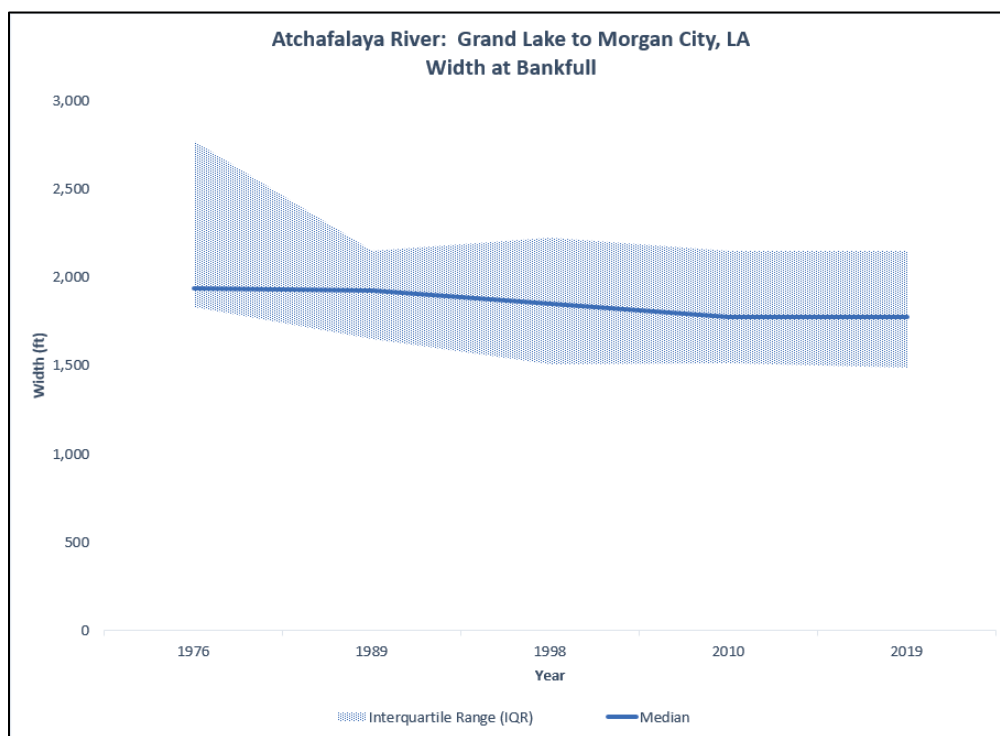


Figure 90. Atchafalaya River Grand Lake to Morgan City, LA, trend plot of channel width at bankfull reference.



3.2.3 Hydraulic depth–Atchafalaya River

Box-and-whisker plots of the computed hydraulic depth referenced to the LWRP for the Atchafalaya River geomorphic reaches are shown in Figures 91 through 93. The trend plots of median hydraulic depth for all reaches are shown in Figures 94 through 96. For the Old River-to-WBPC reach, the trend in hydraulic depth from 1976 to 1998 is steady to slightly decreasing, and slightly increasing from 1998 to 2019.

However, there is very little change overall during the entire time period. The trend for the WBPC-to-Grand Lake reach is increasing from 1978 to 1989 then fluctuates but with very little change from 1989 to 2019. For the Grand Lake-to-Morgan City, LA, reach, the median hydraulic depth is slightly increasing from 1976 to 2010 and then decreases from 2010 to 2019. Note that the IQR for this reach becomes increasingly broader from 1976 to 1998 and remains at that breadth from 1998 to 2019. It is possible this is due to the periodic dredging in the reach, resulting in frequent fluctuations in depth.

Figure 91. Atchafalaya River Old River to WBPC, hydraulic depth at low water reference.

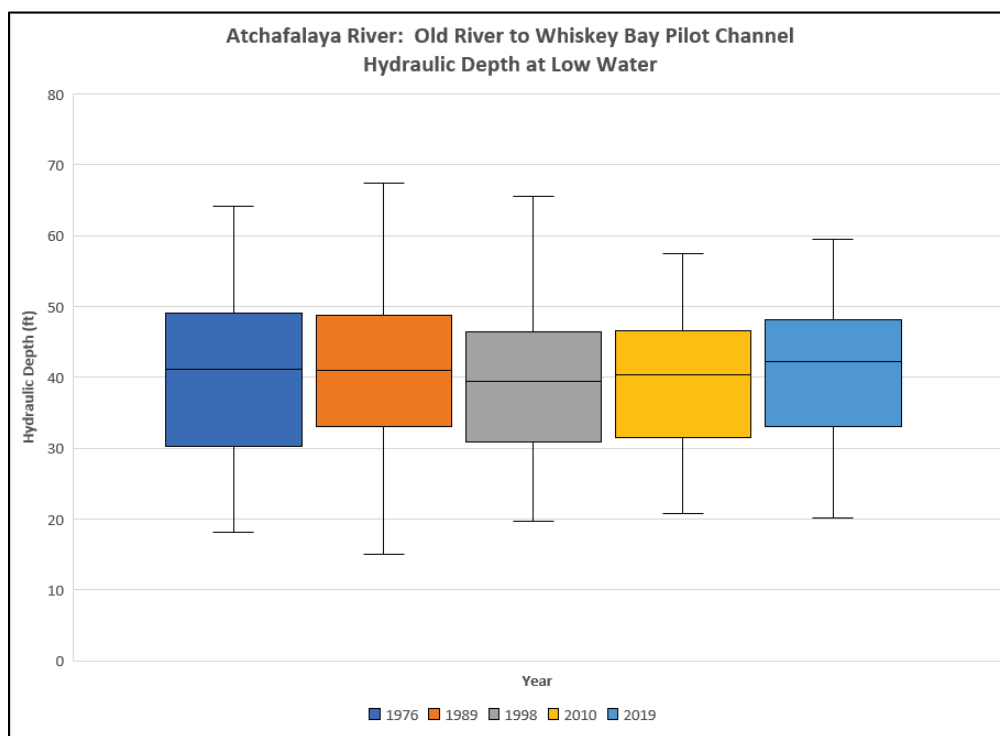


Figure 92. Atchafalaya River WBPC to Grand Lake, hydraulic depth at low water reference.

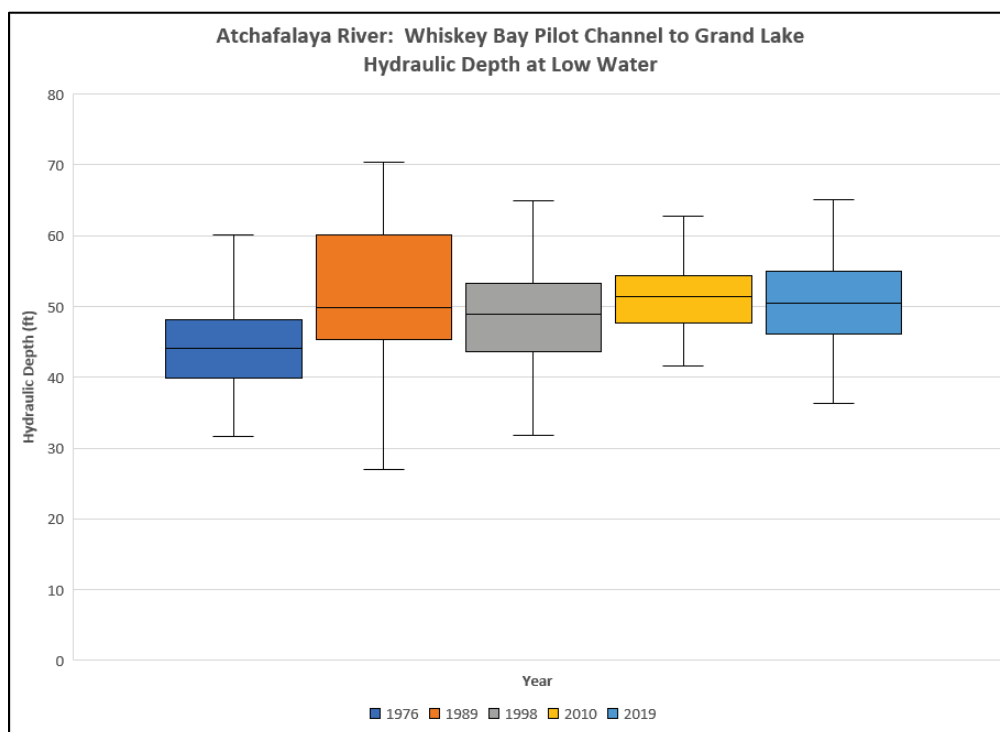


Figure 93. Atchafalaya River Grand Lake to Morgan City, hydraulic depth at low water reference.

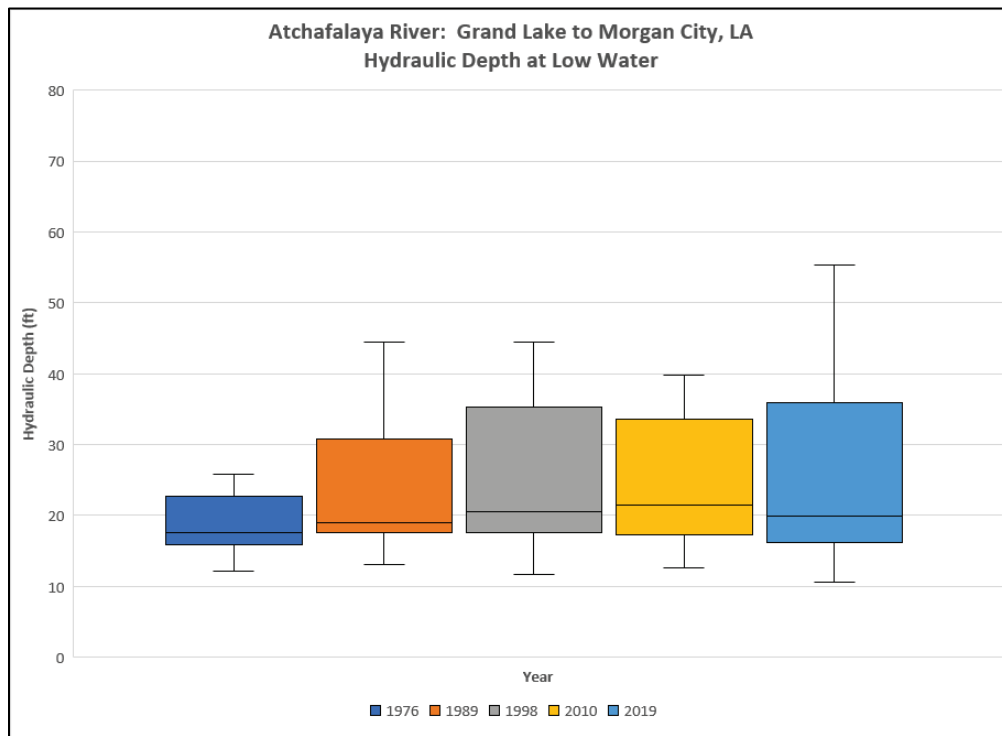


Figure 94. Atchafalaya River Old River to WBPC, trend plot of hydraulic depth at low water reference.

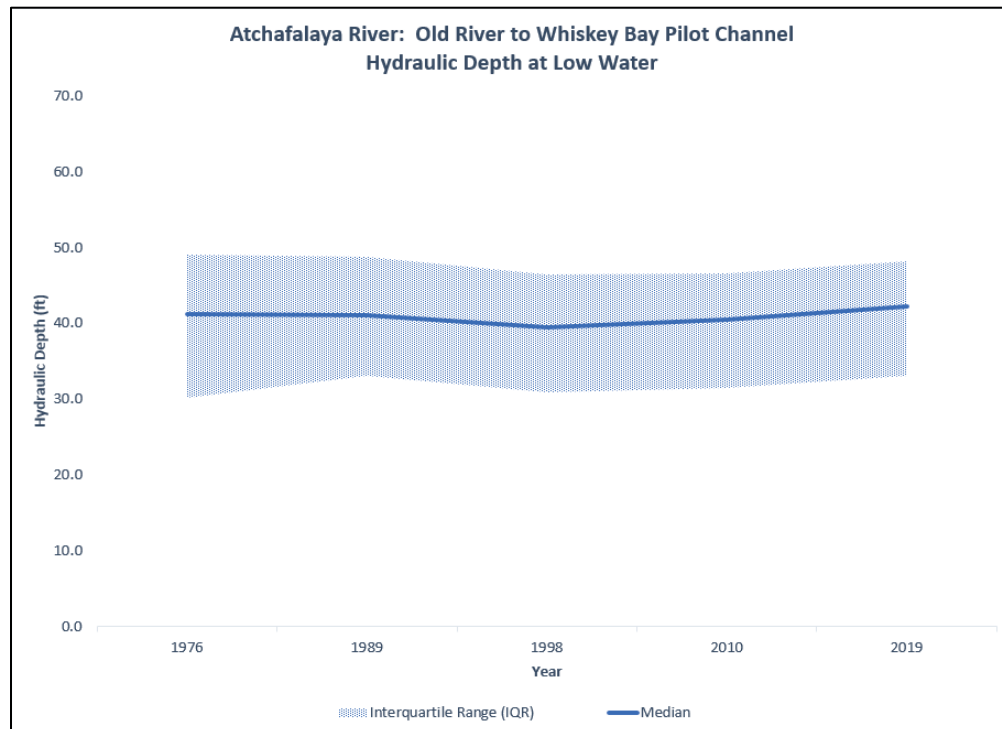


Figure 95. Atchafalaya River WBPC to Grand Lake, trend plot of hydraulic depth at low water reference.

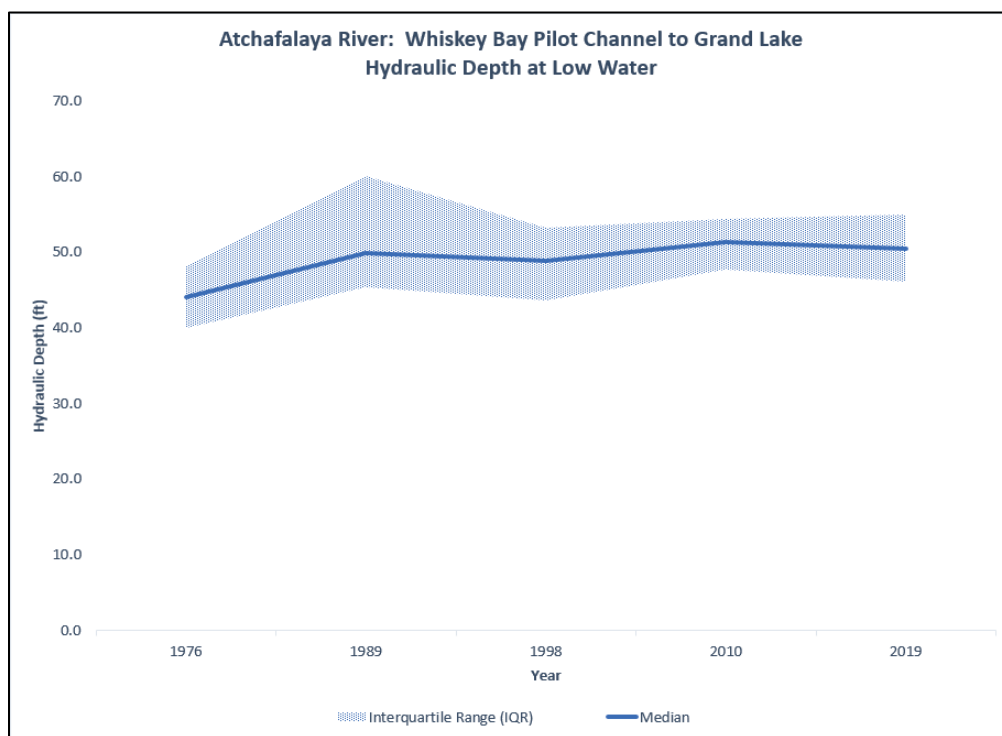
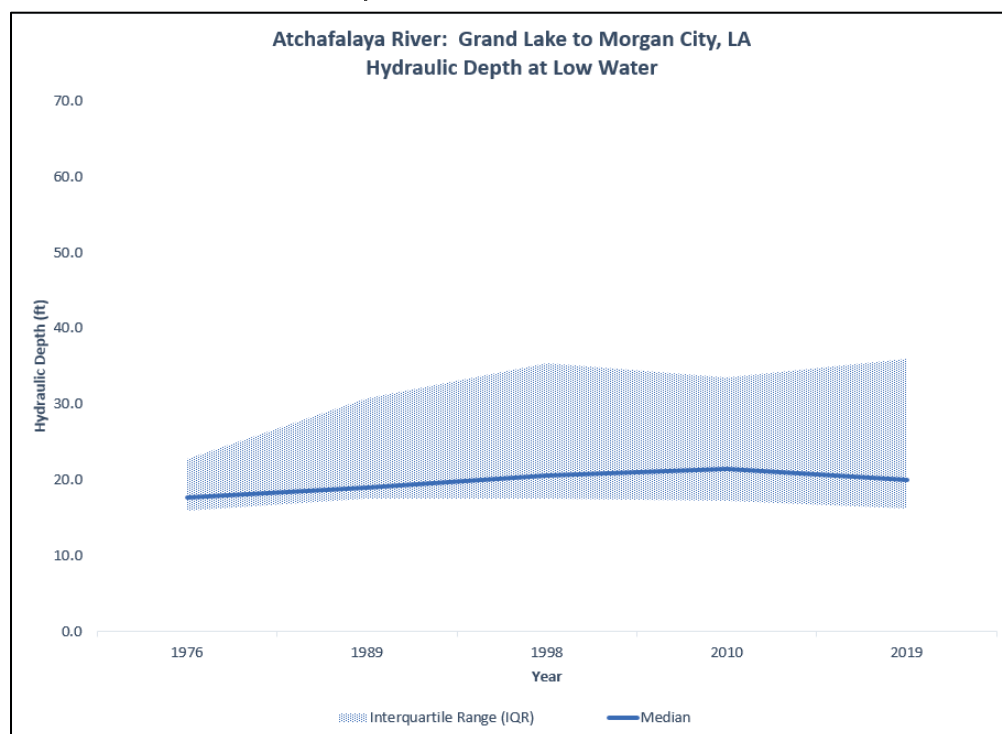


Figure 96. Atchafalaya River Grand Lake to Morgan City, LA, trend plot of hydraulic depth at low water reference.



Box-and-whisker plots of the computed hydraulic depth referenced to bankfull reference plane for the Atchafalaya River geomorphic reaches are shown in Figures 97 through 99. The trend plots of channel width for the reaches are shown in Figures 100 through 102. In general, the trends in median channel width at bankfull reference are very similar to those for the low water referenced data for all three reaches.

Figure 97. Atchafalaya River Old River to WBPC, hydraulic depth at bankfull reference.

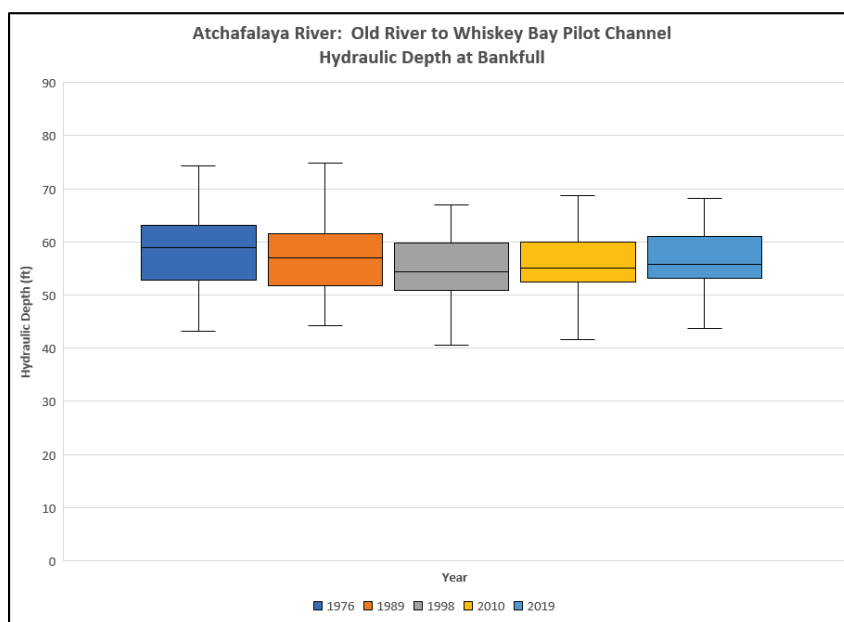


Figure 98. Atchafalaya River WBPC to Grand Lake, hydraulic depth at bankfull reference.

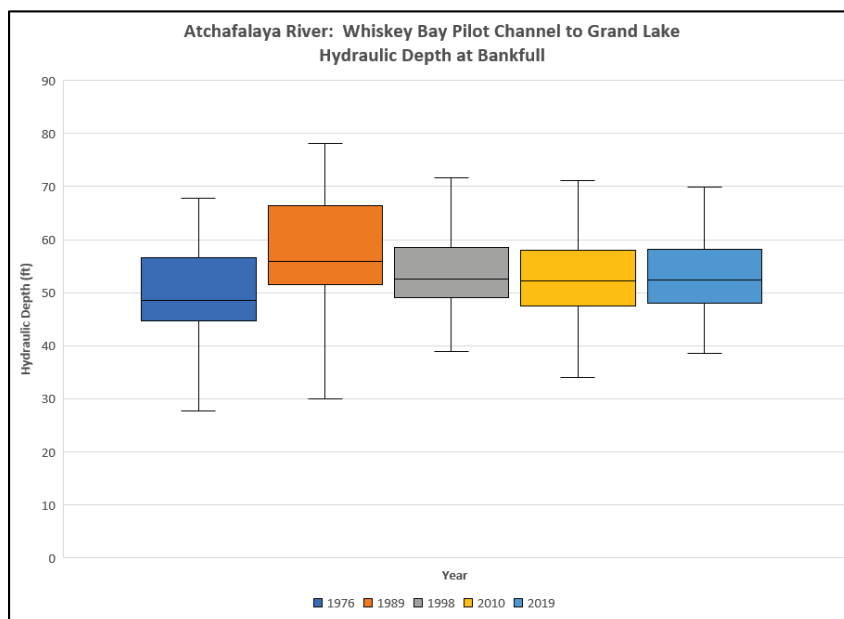


Figure 99. Atchafalaya River Grand Lake to Morgan City, hydraulic depth at bankfull reference.

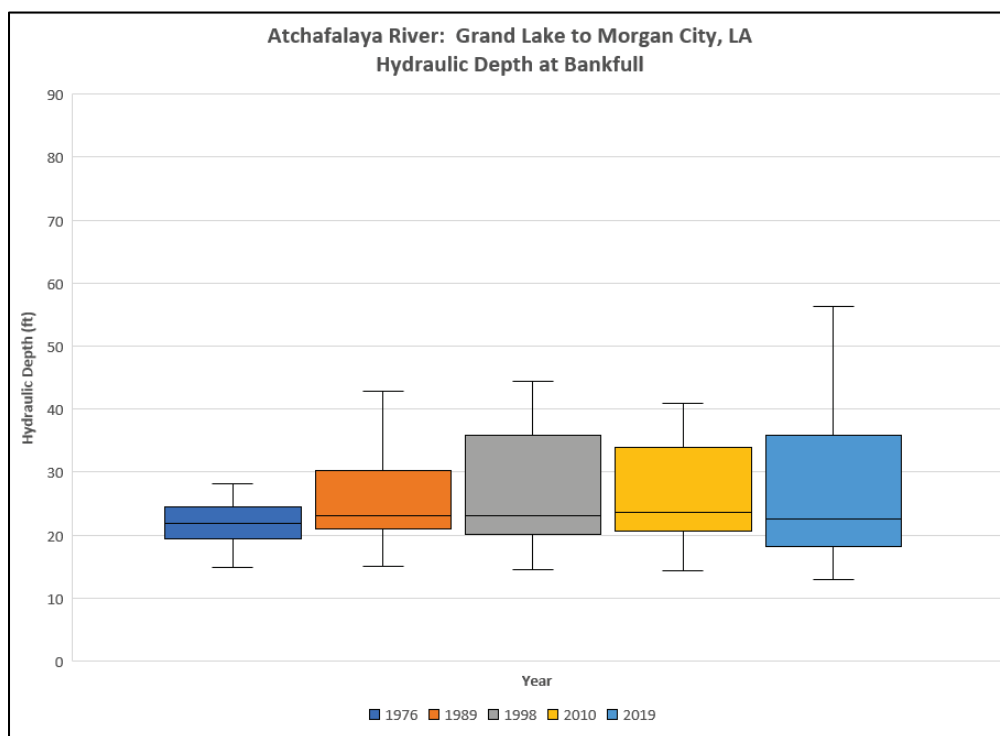


Figure 100. Atchafalaya River Old River to WBPC, trend plot of hydraulic depth at bankfull reference.

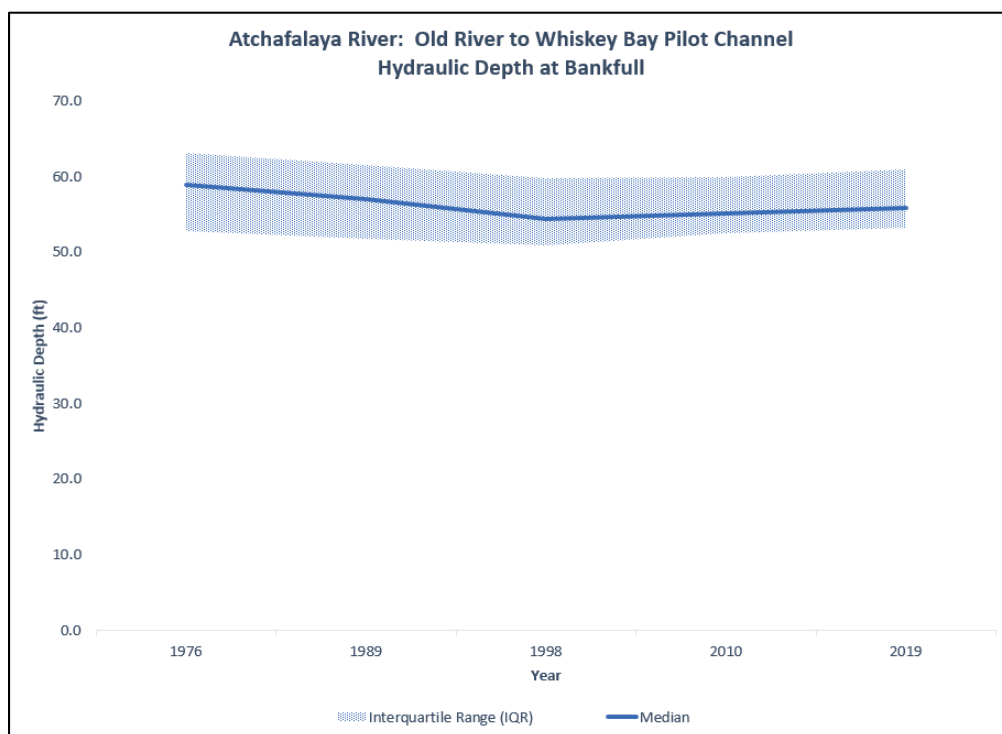


Figure 101. Atchafalaya River WBPC to Grand Lake, trend plot of hydraulic depth at bankfull reference.

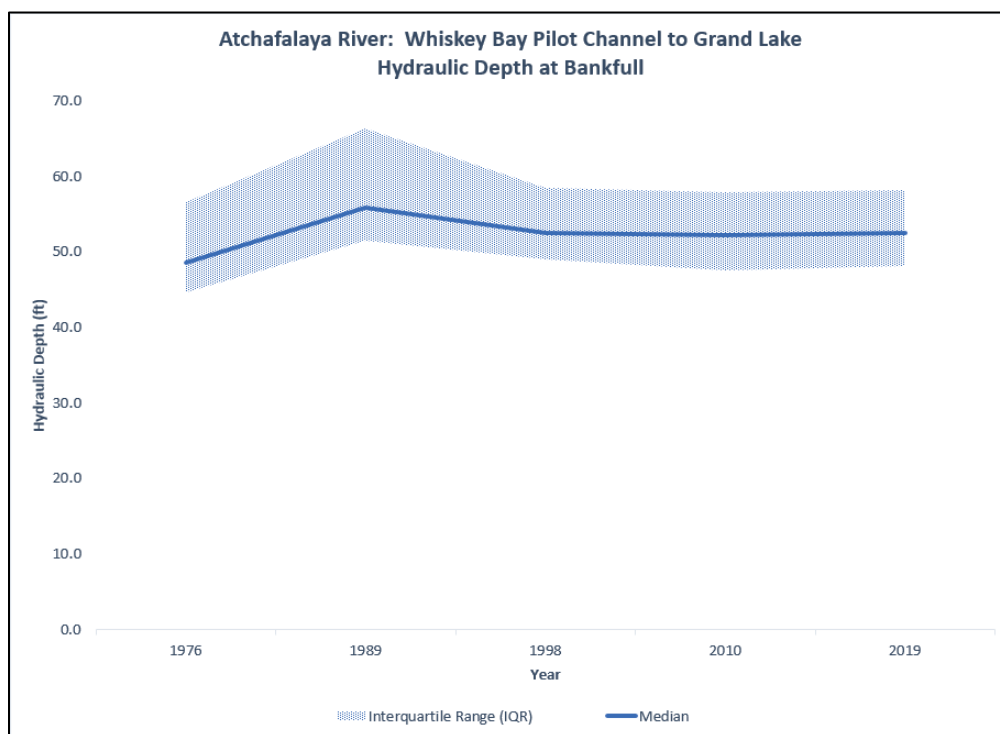
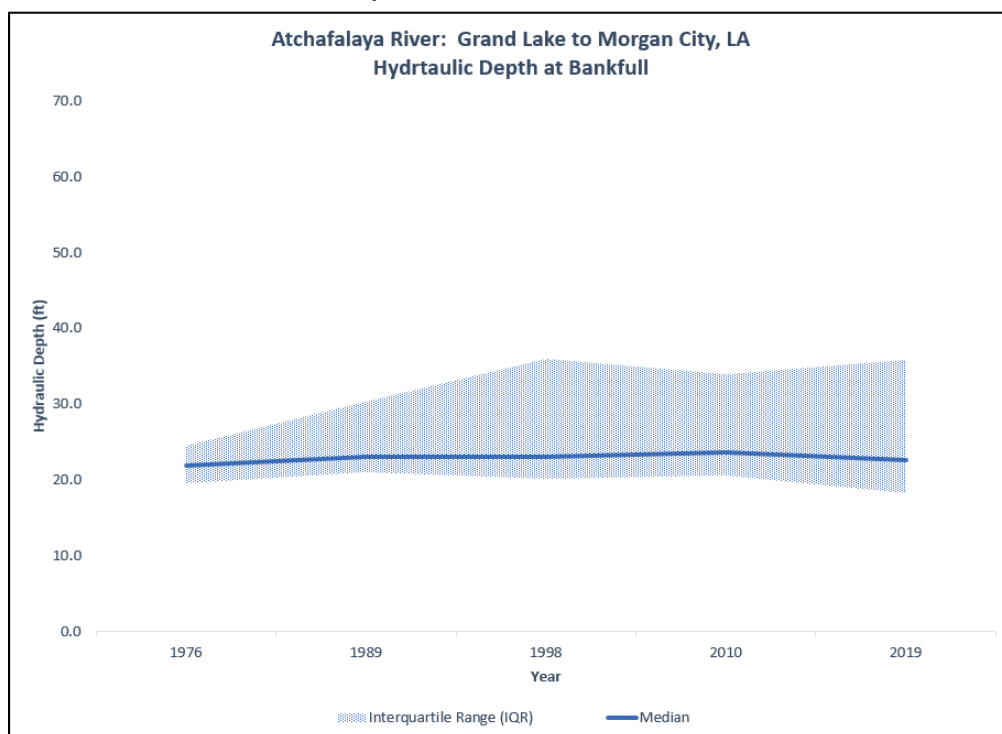


Figure 102. Atchafalaya River Grand Lake to Morgan City, LA, trend plot of hydraulic depth at bankfull reference.



3.2.4 Conveyance–Atchafalaya River

Box-and-whisker plots of the computed conveyance referenced to the LWRP for the Atchafalaya River geomorphic reaches are shown in Figures 103 through 105. The trend plots of median conveyance for all the reaches are shown in Figures 106 through 108. Trends typically reflect those seen for hydraulic depth and cross-sectional area. For the Old River-to-WBPC reach, the median conveyance is fairly stable from 1976 to 1989, decreases slightly from 1989 to 1998, and increases from 1998 to 2019. The trend for the WBPC-to-Grand Lake reach is generally increasing conveyance from 1976 to 2019, although there is variability in the rate of increase over the time period. The Grand Lake-to-Morgan City, LA, reach shows a slight increase in median conveyance from 1976 to 1989, then a stable to slightly decreasing trend from 1989 to 2019. As was the case for hydraulic depth, the spread of the IQR for this reach broadens over the survey time period.

Figure 103. Atchafalaya River Old River to WBPC, conveyance at low water reference.

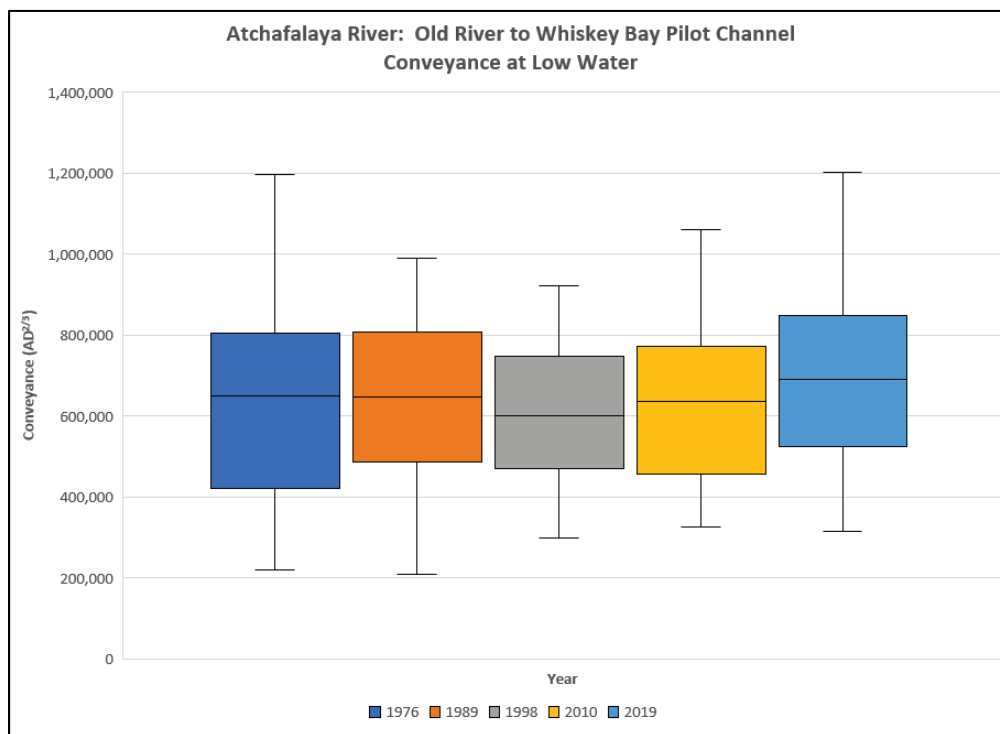


Figure 104. Atchafalaya River WBPC to Grand Lake, conveyance at low water reference.

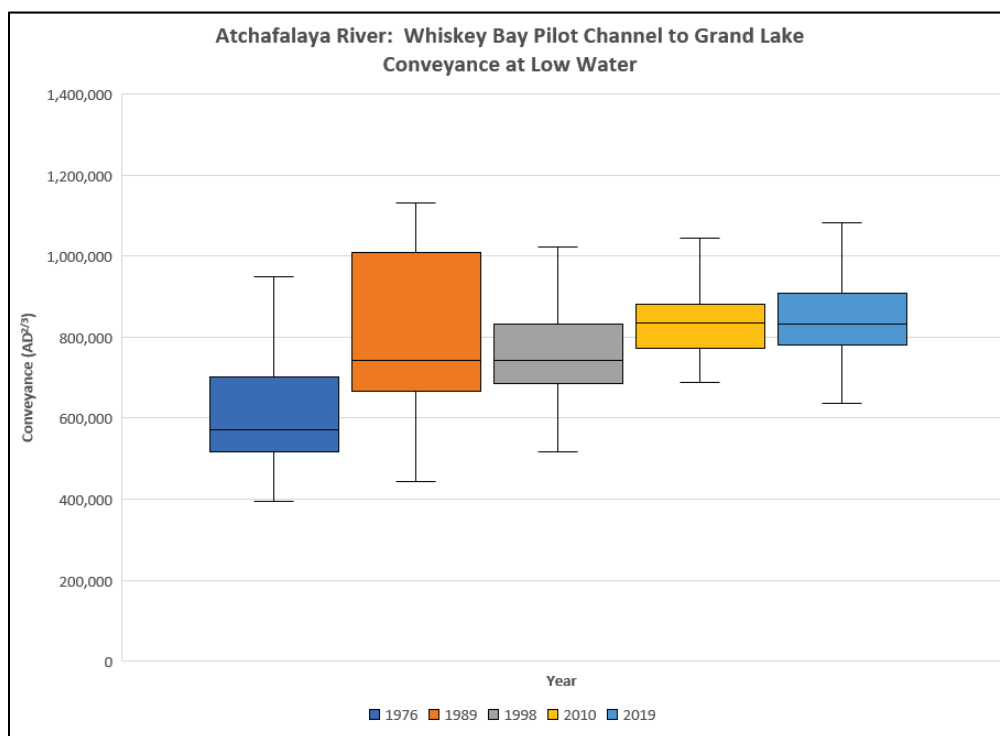


Figure 105. Atchafalaya River Grand Lake to Morgan City, conveyance at low water reference.

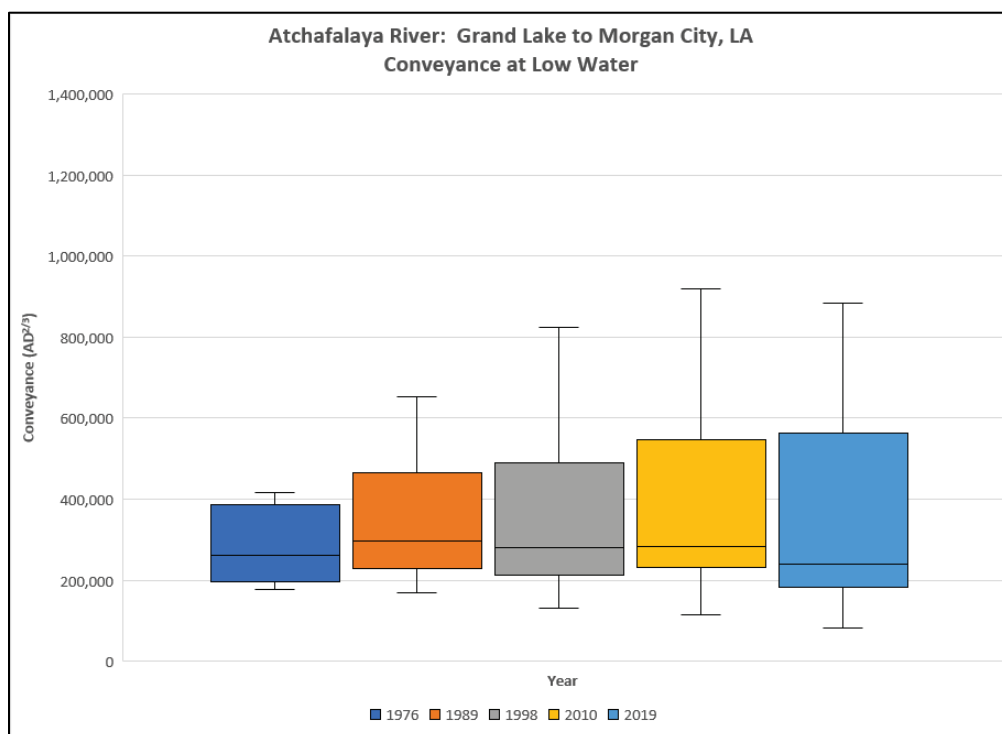


Figure 106. Atchafalaya River Old River to WBPC, trend plot of conveyance at low water reference.

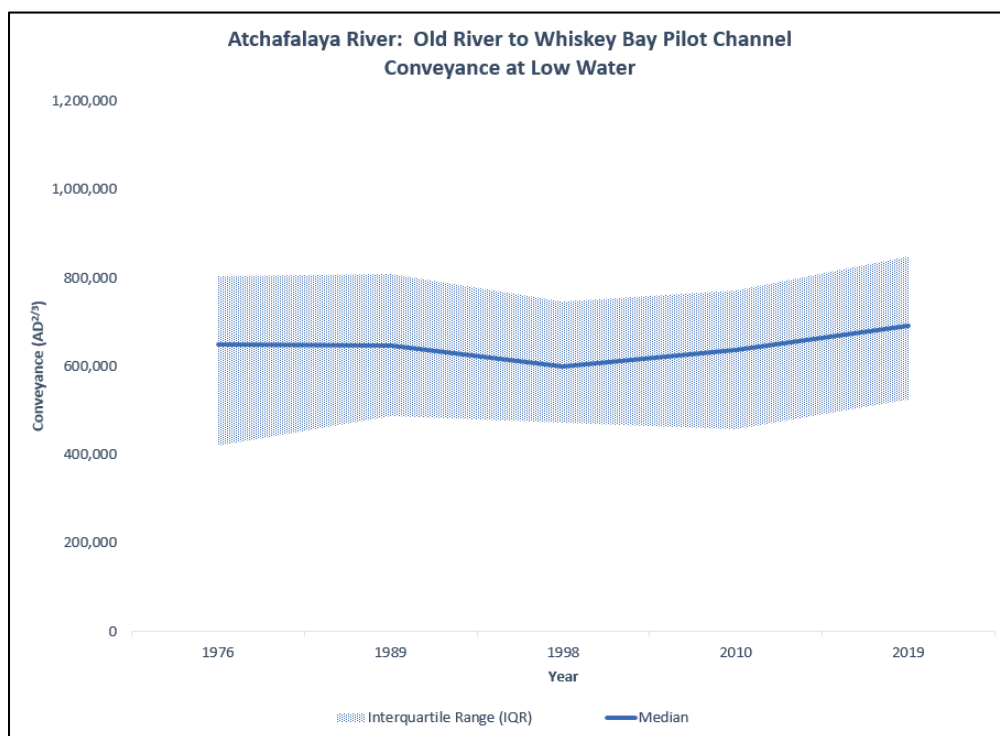


Figure 107. Atchafalaya River WBPC to Grand Lake, trend plot of conveyance at low water reference.

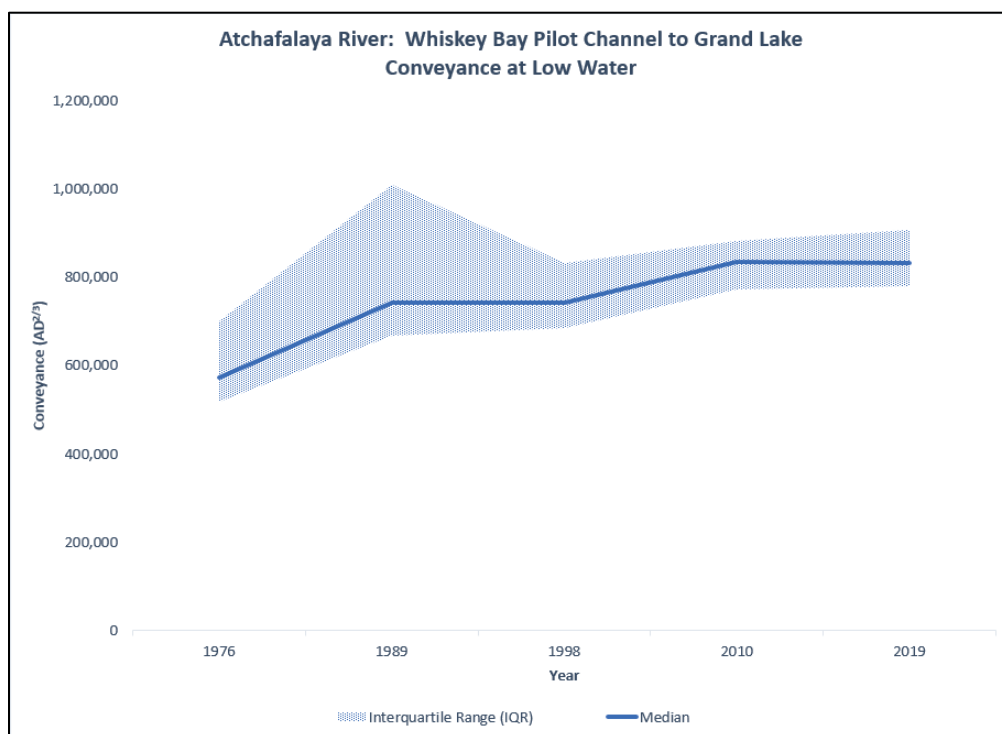
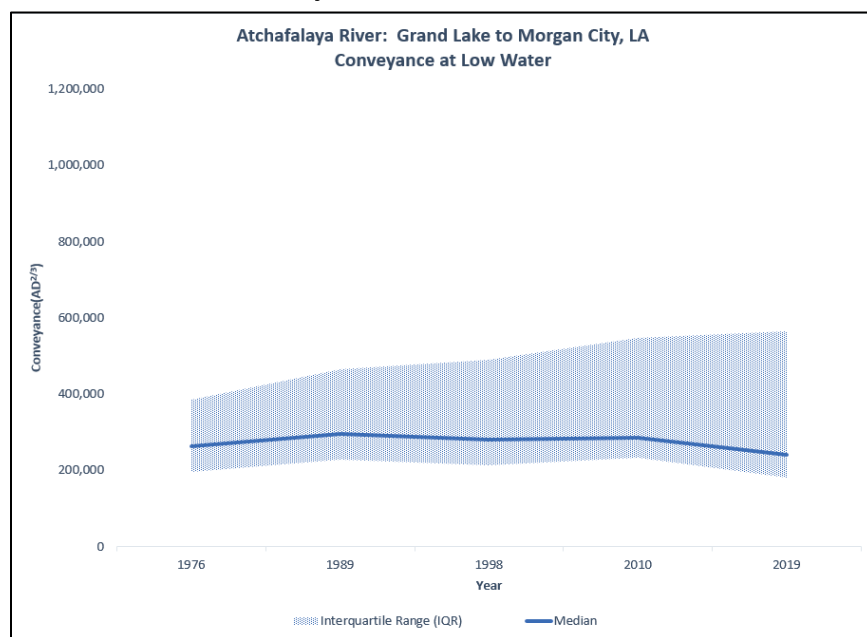


Figure 108. Atchafalaya River Grand Lake to Morgan City, LA, trend plot of conveyance at low water reference.



Box-and-whisker plots of the computed conveyance referenced to bankfull reference plane for the Atchafalaya River geomorphic reaches are shown in Figures 109 through 111. The trend plots of channel width for the reaches are shown in Figures 112 through 114. In general, the trends in median conveyance at bankfull reference are very similar to those for the low water referenced data for all three reaches.

Figure 109. Atchafalaya River Old River to WBPC, conveyance at bankfull reference.

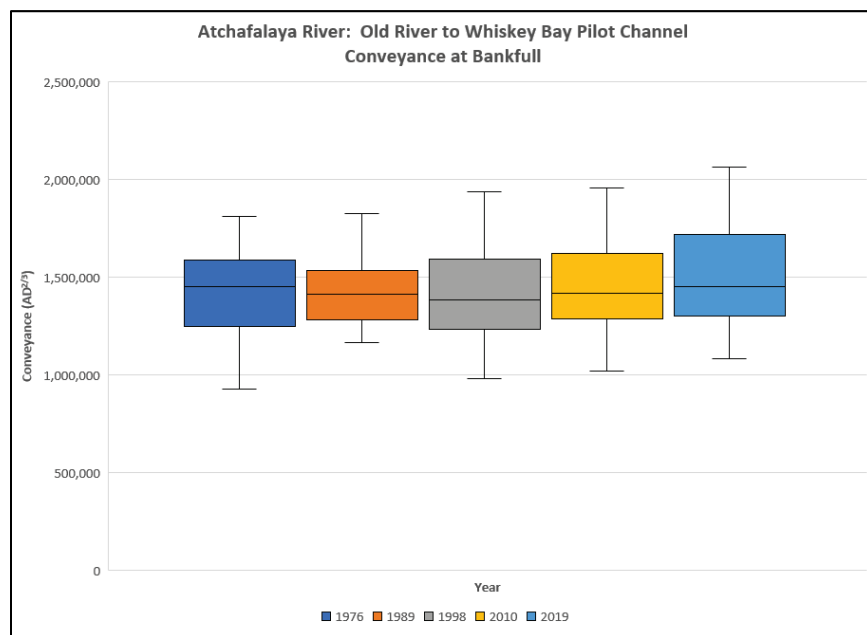


Figure 110. Atchafalaya River WBPC to Grand Lake, conveyance at bankfull reference.

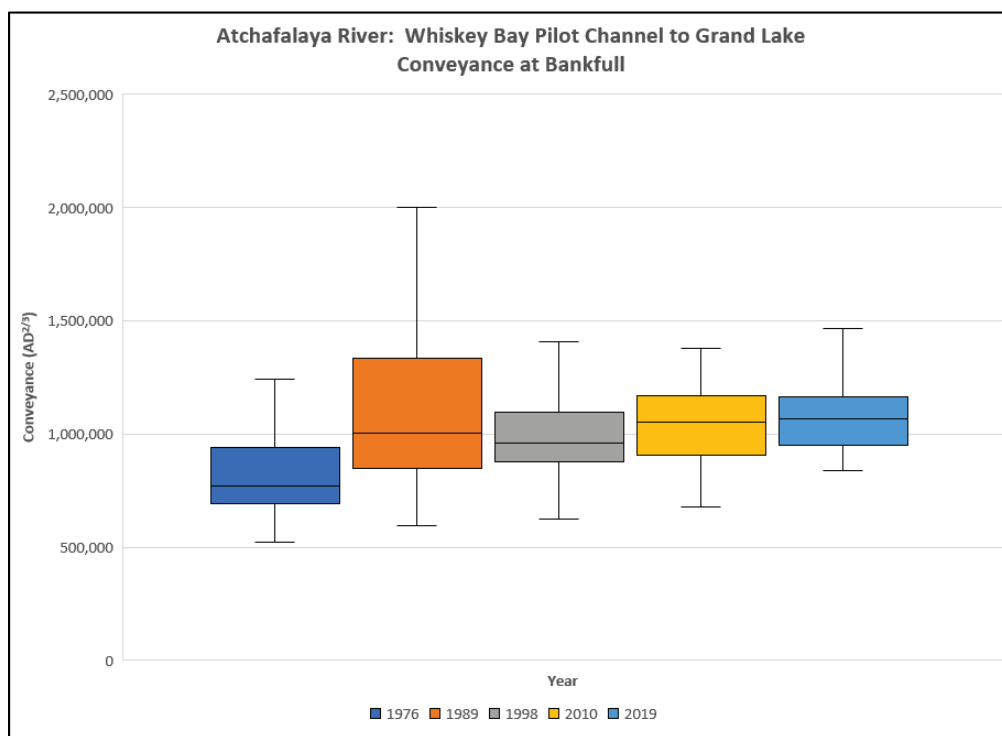


Figure 111. Atchafalaya River Grand Lake to Morgan City, conveyance at bankfull reference.

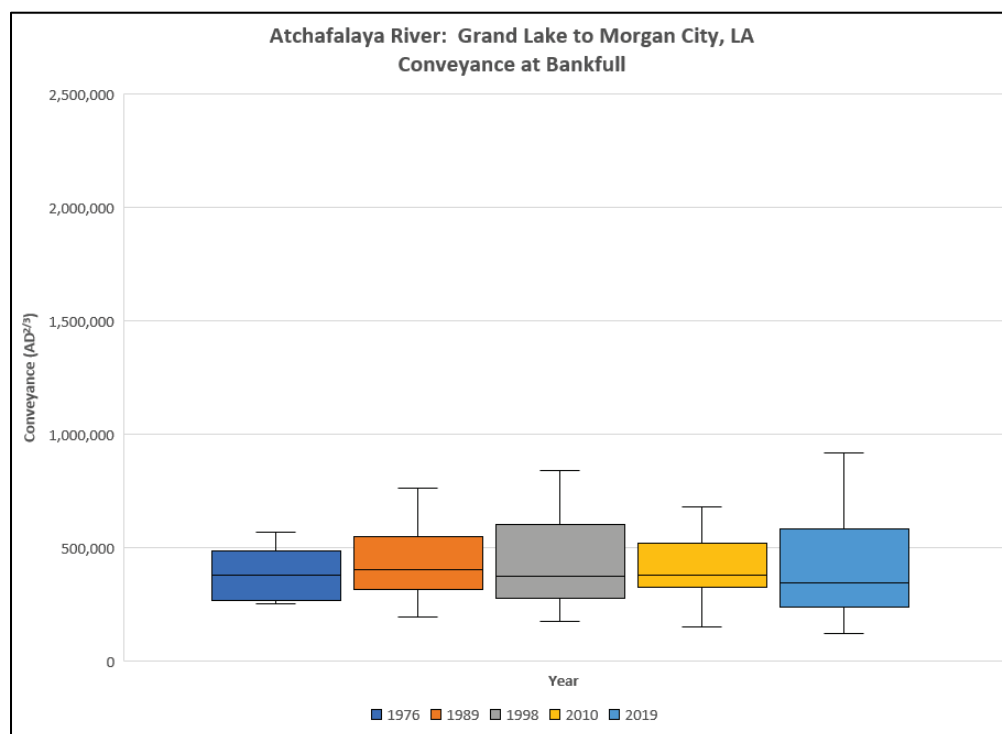


Figure 112. Atchafalaya River Old River to WBPC, trend plot of conveyance at bankfull reference.

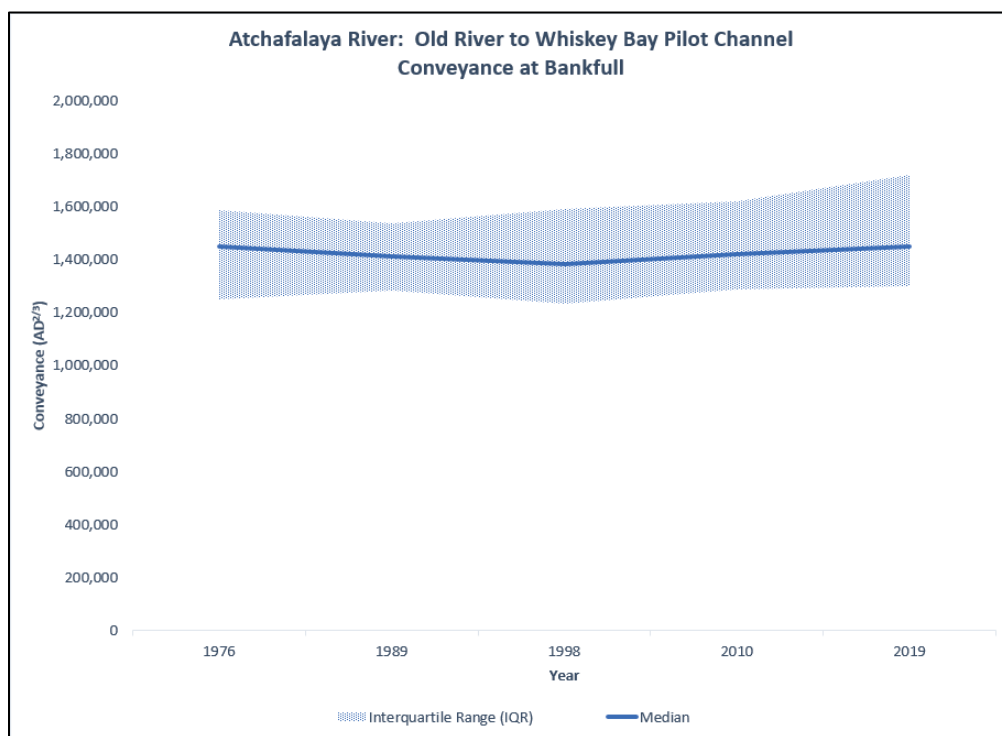


Figure 113. Atchafalaya River WBPC to Grand Lake, trend plot of conveyance at bankfull reference.

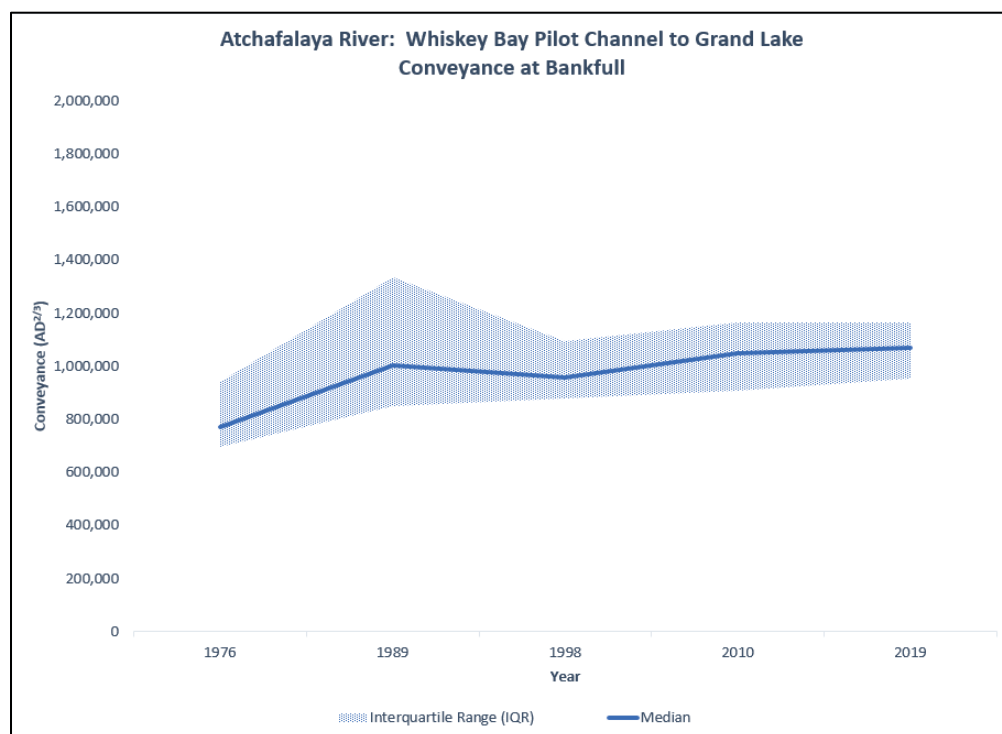
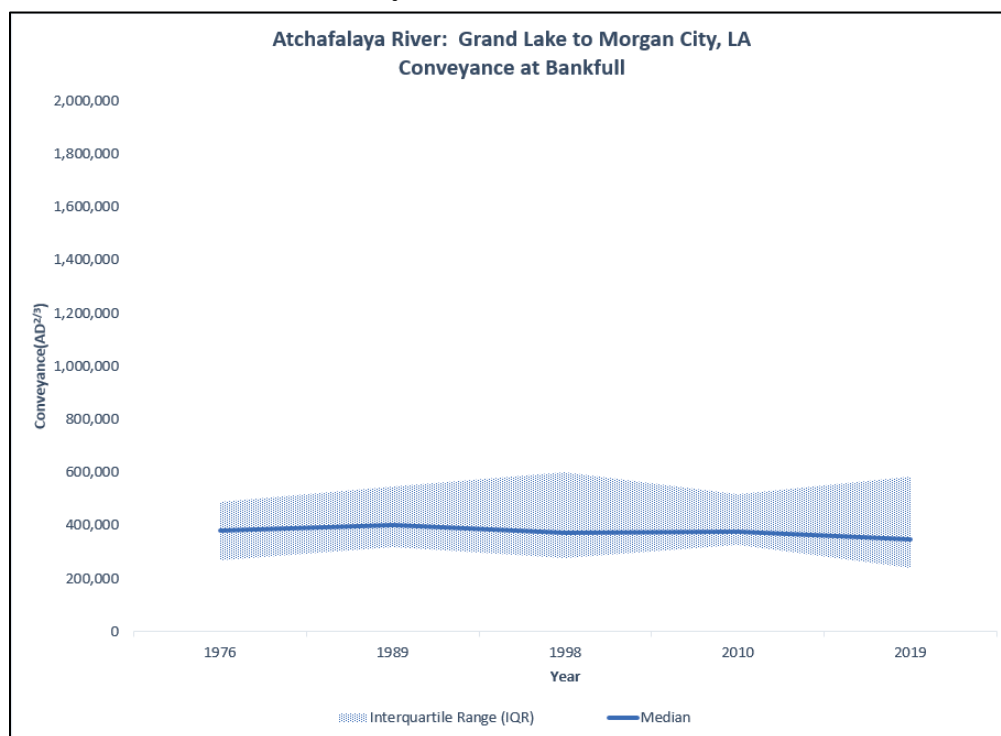


Figure 114. Atchafalaya River Grand Lake to Morgan City, LA, trend plot of conveyance at bankfull reference.



3.2.5 W/D ratio–Atchafalaya River

The box-and-whisker plots of W/D ratio at low water reference for the three Atchafalaya River geomorphic reaches are shown in Figures 115 through 117, and the trend plots for the reaches are shown in Figures 118 through 120. The trend in median W/D ratio for the Old River-to-WBPC reach indicates a very consistent ratio over the entire survey time period. For the WBPC-to-Grand Lake reach, the trend in W/D ratio decreases from 1976 to 1989, then generally increase with fluctuations from 1989 to 2019. Although there is fluctuation as noted between survey periods, the overall trend for the entire time period has been fairly consistent. The trend in ratio for the Grand Lake-to-Morgan City, LA, reach shows a decrease in median value from 1976 to 2010, and a generally consistent to slightly increasing median value from 2010 to 2019.

Figure 115. Atchafalaya River Old River to WBPC, W/D ratio at low water reference.

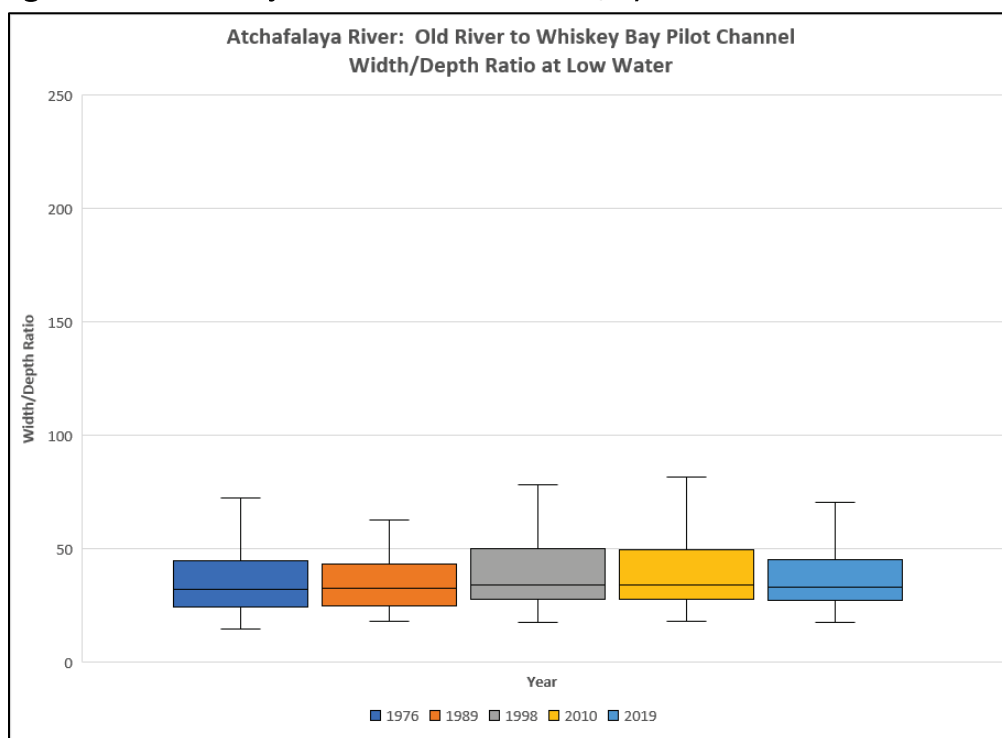


Figure 116. Atchafalaya River WBPC to Grand Lake, W/D ratio at low water reference.

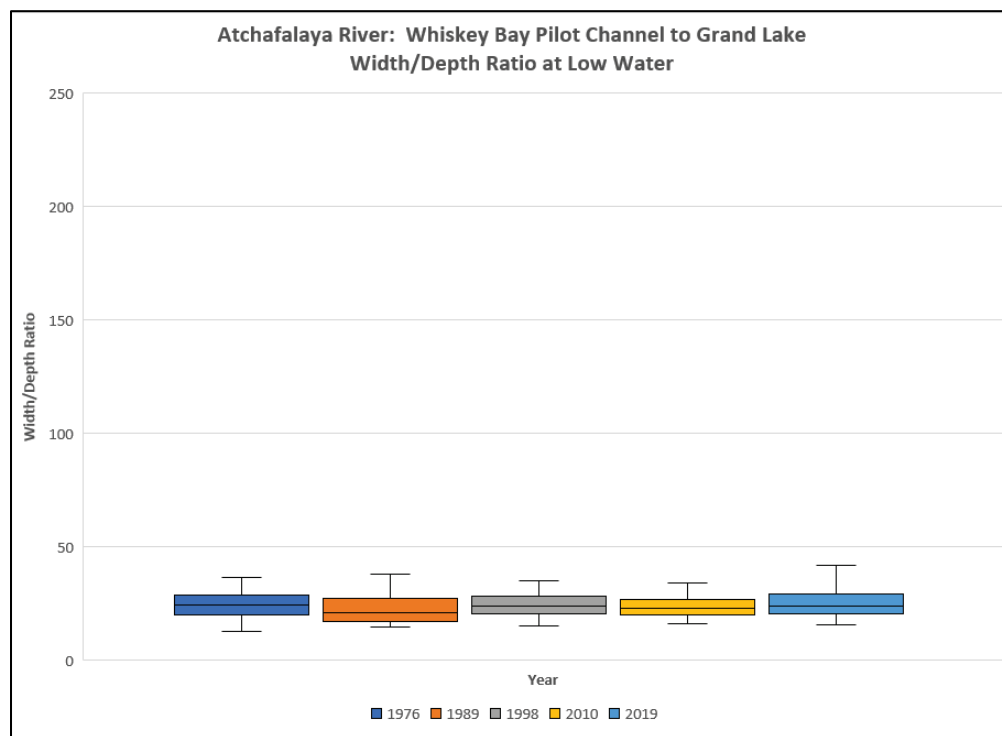


Figure 117. Atchafalaya River Grand Lake to Morgan City, W/D ratio at low water reference.

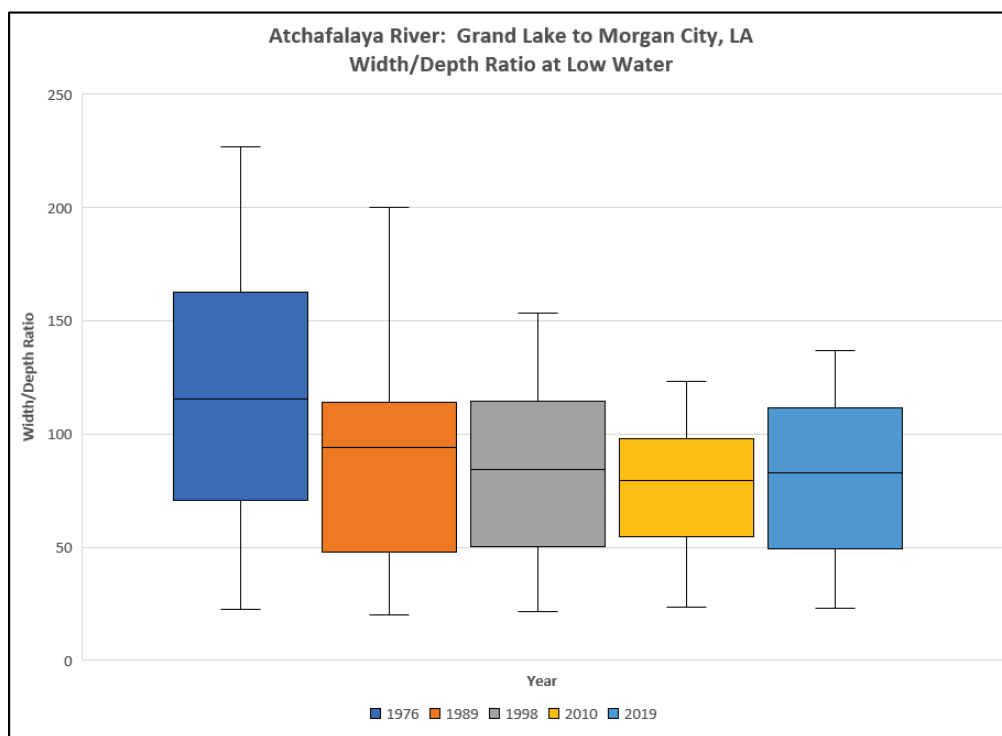


Figure 118. Atchafalaya River Old River to WBPC, trend plot of W/D ratio at low water reference.

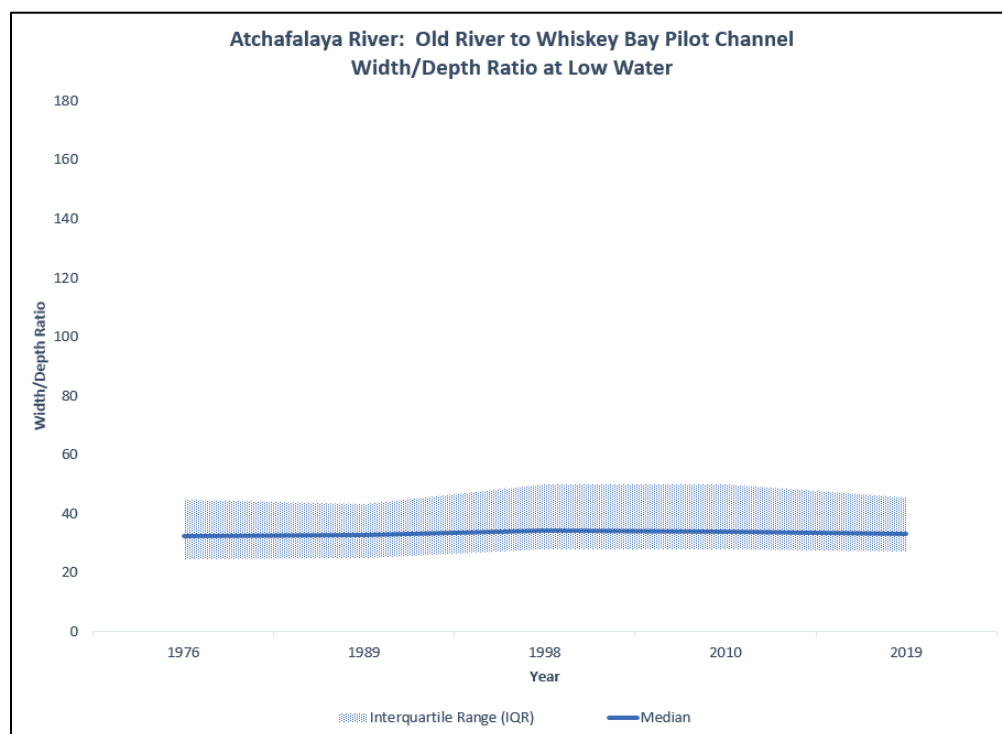


Figure 119. Atchafalaya River WBPC to Grand Lake, trend plot of W/D ratio at low water reference.

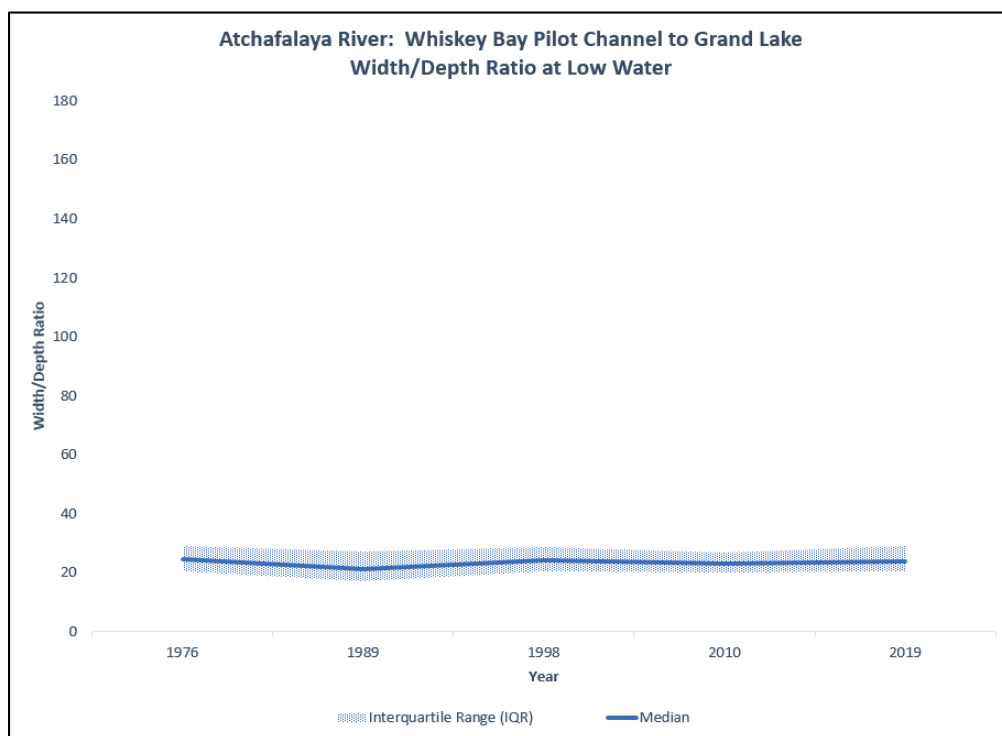
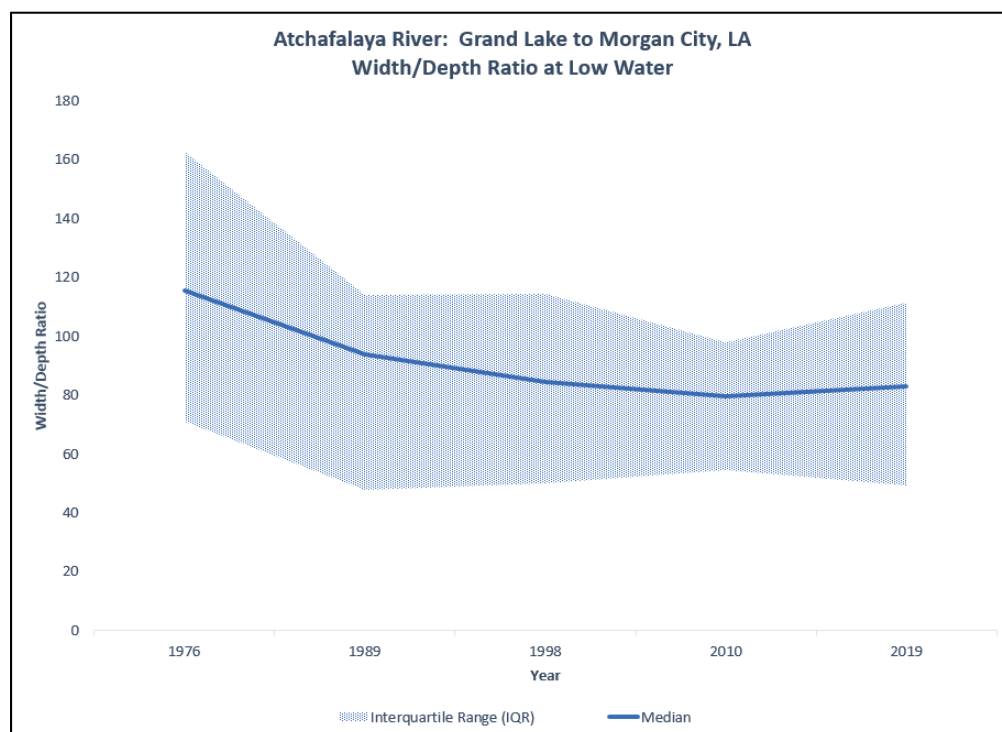


Figure 120. Atchafalaya River Grand Lake to Morgan City, LA, trend plot of W/D ratio at low water reference.



Box-and-whisker plots of the W/D ratio referenced to bankfull reference plane for the Atchafalaya River geomorphic reaches are shown in Figures 121 through 123. The trend plots of channel width for the reaches are shown in Figures 124 through 126. In general, the trends in median W/D ratio at bankfull reference are very similar to those for the low water referenced data for all three reaches. Compared to the low water referenced data, there is more of an increasing trend for the W/D ratio at bankfull reference for the Old River-to-WBPC reach. For the WBPC-to-Grand Lake reach, the trend in W/D ratio is similar to the low water referenced data, with fluctuations but an overall consistent median value over the survey time period. For the Grand Lake-to-Morgan City, LA, reach, the trend for the bankfull reference data are essentially the same as the low water referenced data.

Figure 121. Atchafalaya River Old River to WBPC, W/D ratio at bankfull reference.

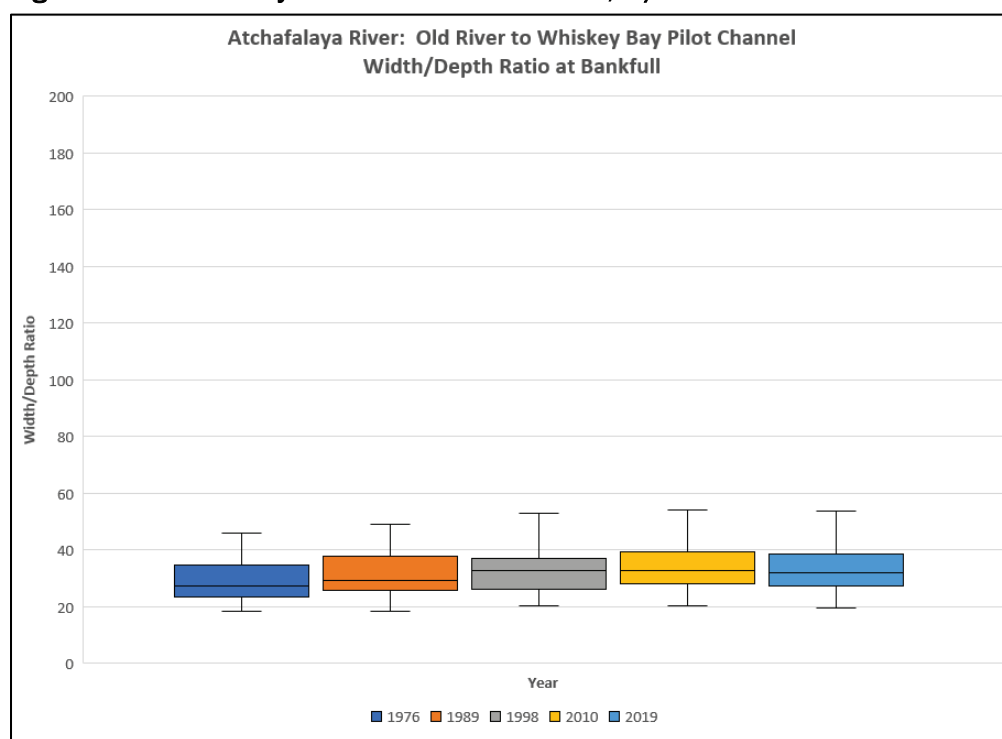


Figure 122. Atchafalaya River WBPC to Grand Lake, conveyance at W/D ratio reference.

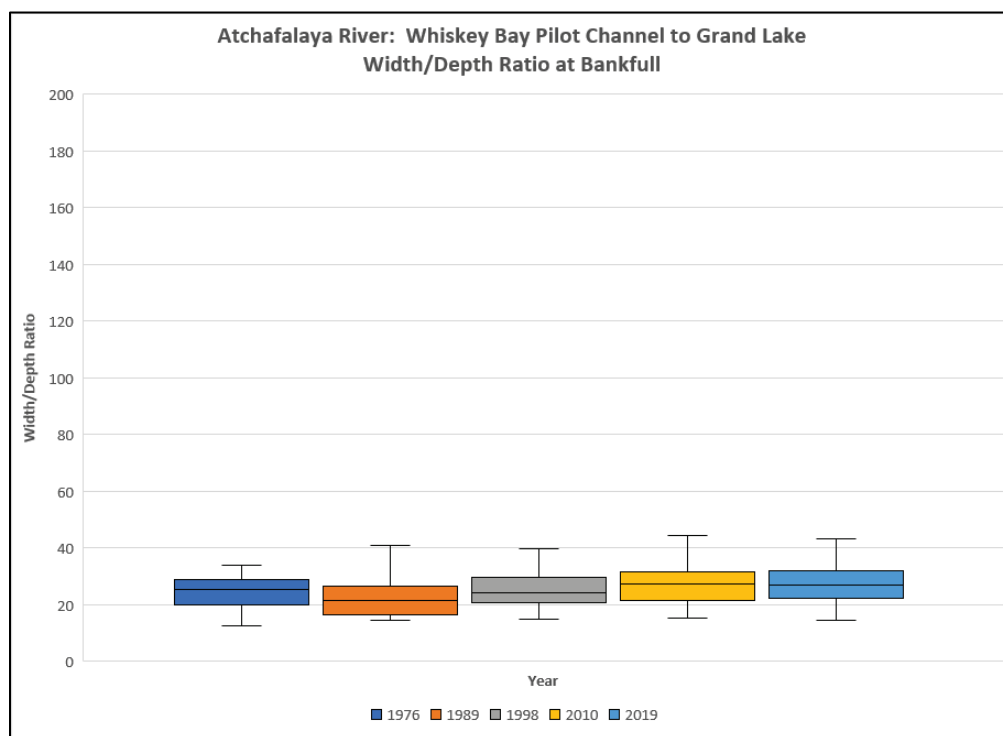


Figure 123. Atchafalaya River Grand Lake to Morgan City, W/D ratio at bankfull reference.

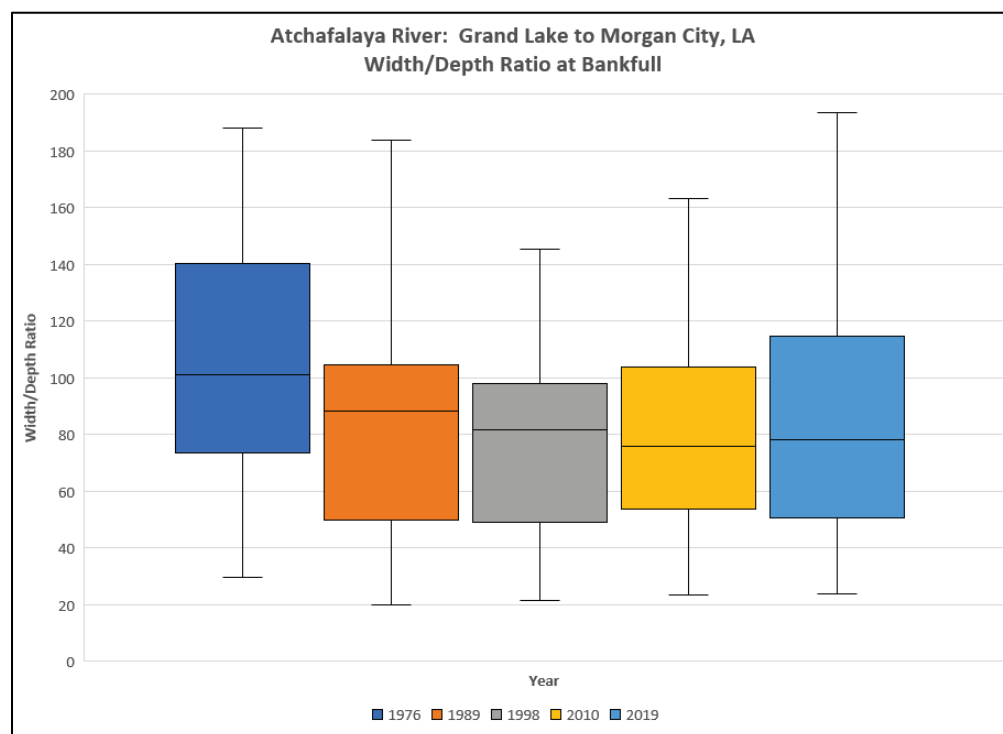


Figure 124. Atchafalaya River Old River to WBPC, trend plot of W/D ratio at bank full reference.

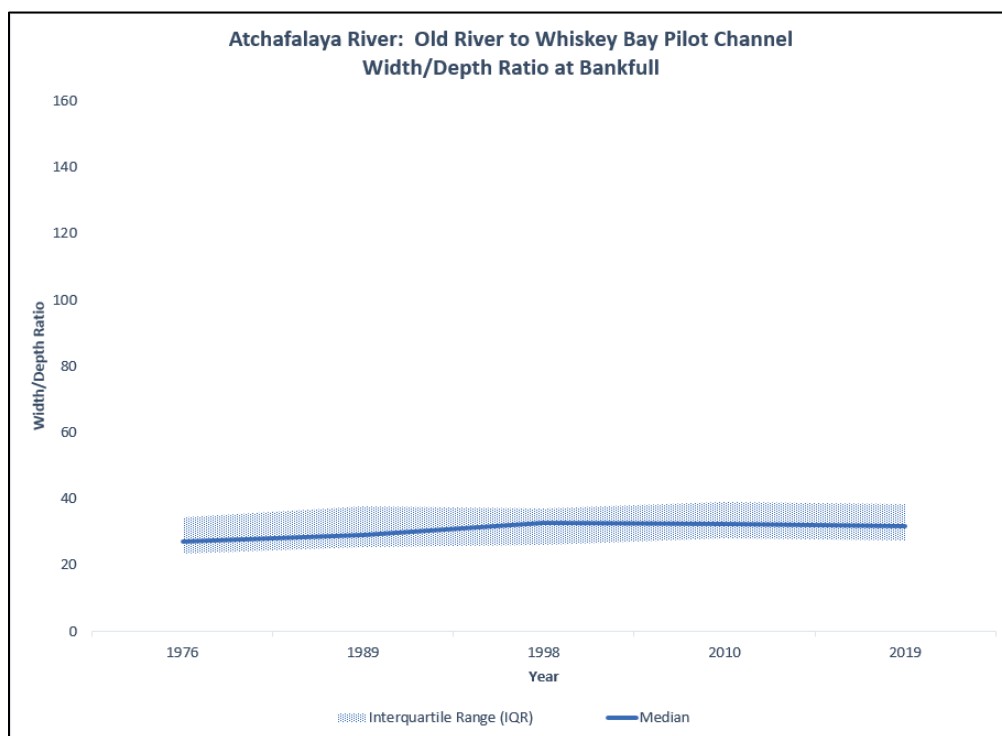


Figure 125. Atchafalaya River WBPC to Grand Lake, trend plot of W/D ratio at bankfull reference.

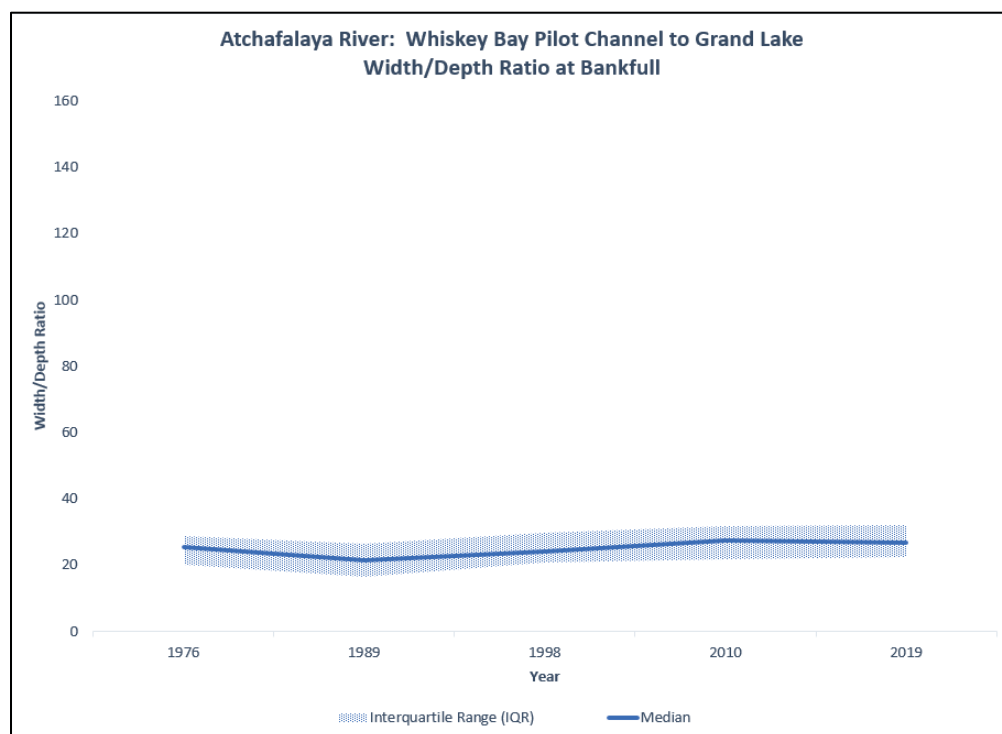
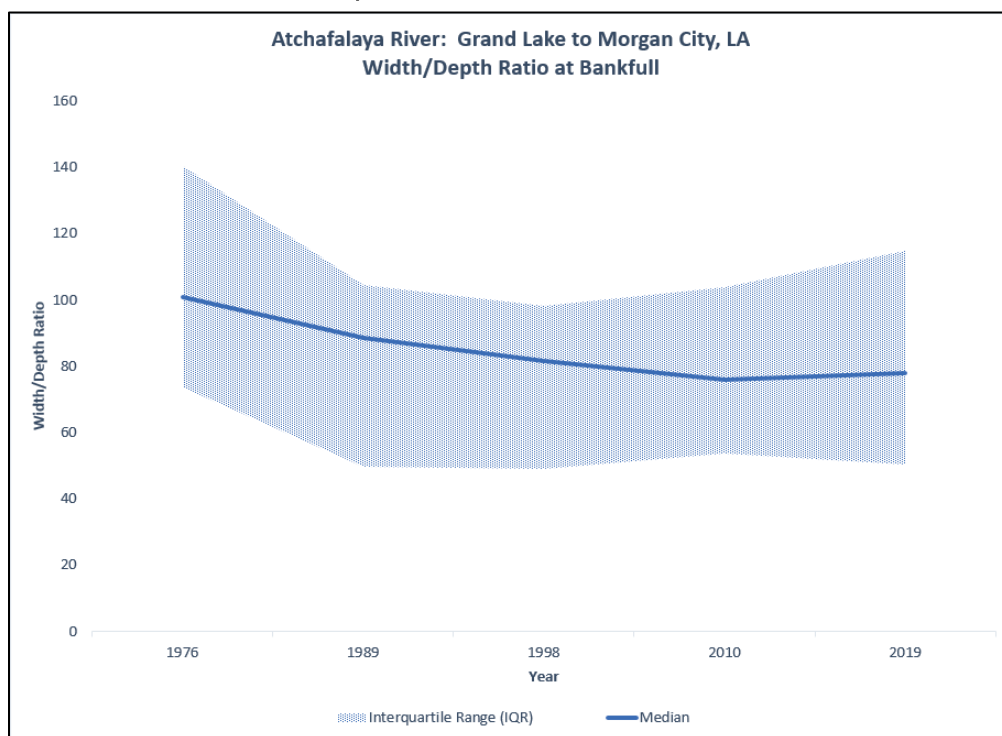


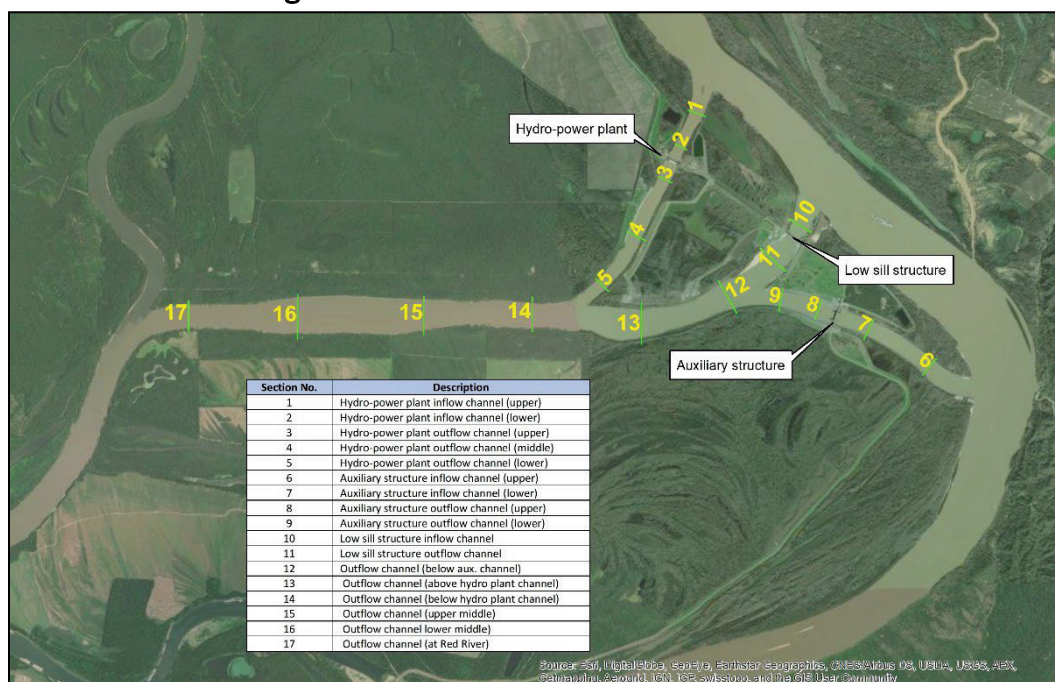
Figure 126. Atchafalaya River Grand Lake to Morgan City, LA, trend plot of W/D ratio at bankfull reference.



3.3 Geometric parameter analyses–Old River

The geometric parameter analysis conducted for Old River differs slightly in methodology from the analyses conducted for the Mississippi River and Atchafalaya River. First, the analysis is limited to survey periods 1963 and later, since the Lower Old River channel was dammed in 1963. Note that survey time periods were even shorter for the auxiliary structure (1986) and the hydropower plant (1990). Second, the analysis uses the geometric parameters for each cross section of Old River, rather than the statistical box-and-whisker plots used by reach for the larger rivers. The cross sections for the Old River analysis are located at specific locations upstream and downstream of the structures rather than at equal 1 mi intervals. The location of the cross sections is shown in Figure 127.

Figure 127. Location of ORCC cross sections.

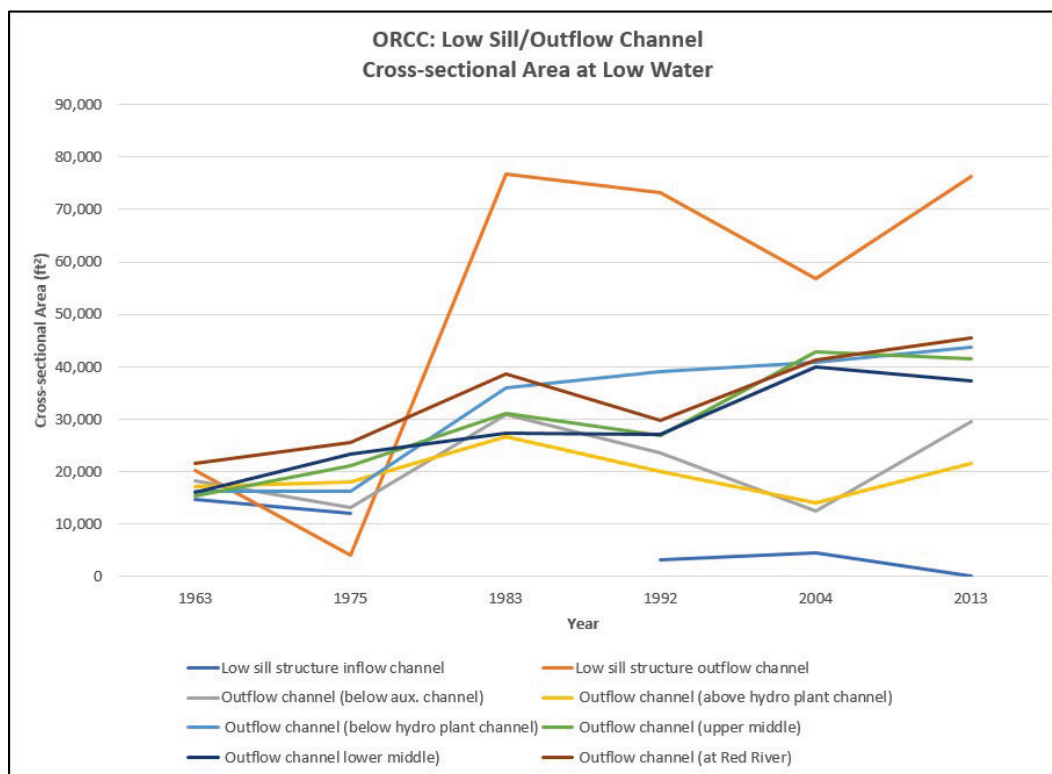


3.3.1 Cross-sectional area–Old River

The plot of cross-sectional area at low water reference for the low sill and outflow channel is shown in Figure 128. The low sill and outflow channel are the oldest features of the ORCS, with the outflow channel constructed in 1962–1963. There is variability in the cross-sectional area, but the plot indicates a general trend of decreasing area for the low sill inflow channel over the period 1963 to 2013. This may be a result of the auxiliary structure becoming the primary ORCC component for passing flow that exceeds the capacity of the hydropower plant. The other notable trend indicated by the plot is the significant increase in area at the section just downstream of the low sill structure. Significant erosion has occurred at this location beginning with the 1983 survey and continuing to 2013, with the exception of a temporary decrease in area in 2004. The cross sections between the auxiliary structure outflow channel and hydropower plant outflow channel indicate a decrease in area from 1983 to 2004 but otherwise show a slight increasing trend. All the other outflow sections between the hydropower plant outflow channel and the Red River indicate a fairly steady increase in area over the survey periods. These sections represent the portion of the outflow channel that carries the total discharge from the low sill structure, auxiliary structure, and hydropower plant. The plot of area for these sections indicates the channel area at low

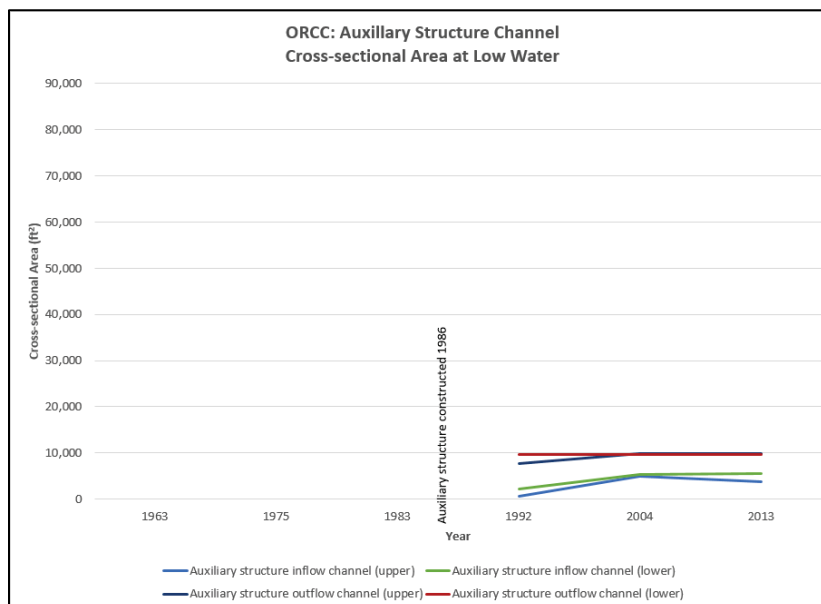
water reference has more than doubled from 1963 to 2013, increasing through erosion from approximately 18,000 ft² to 40,000 ft².

Figure 128. ORCC low sill/outflow channel, cross-sectional area at low water reference.



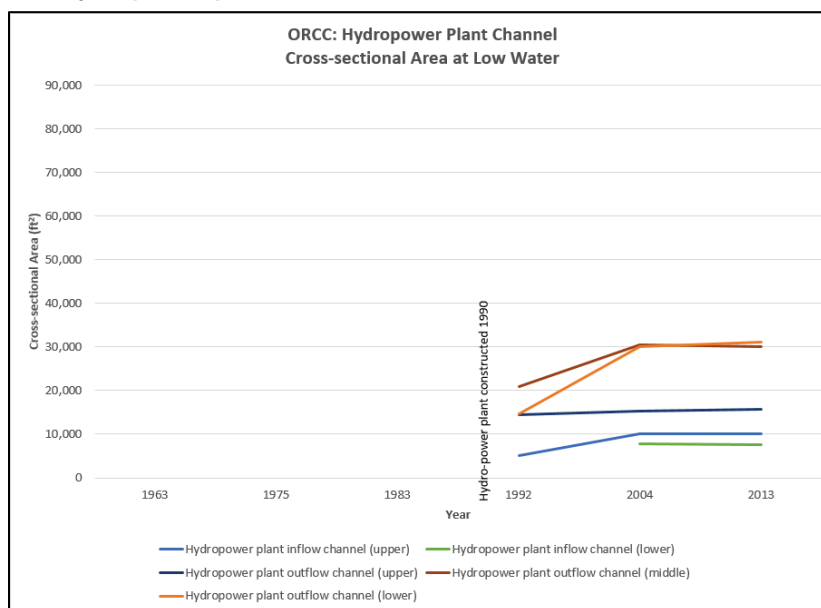
The plot of cross-sectional area at low water reference for the auxiliary structure channel is shown in Figure 129. The plot indicates the sections upstream of the auxiliary structure increased in area from 1992 to 2004, and then have been relatively stable. The sections downstream of the structure indicate the area is approximately twice that of the sections upstream of the structure. Previous studies have determined the channel upstream of the auxiliary structure can act as a sediment sink, requiring periodic sediment flushing operations with the structure gates (Heath et al. 2015).

Figure 129. Auxiliary structure channel, cross-sectional area at low water reference.



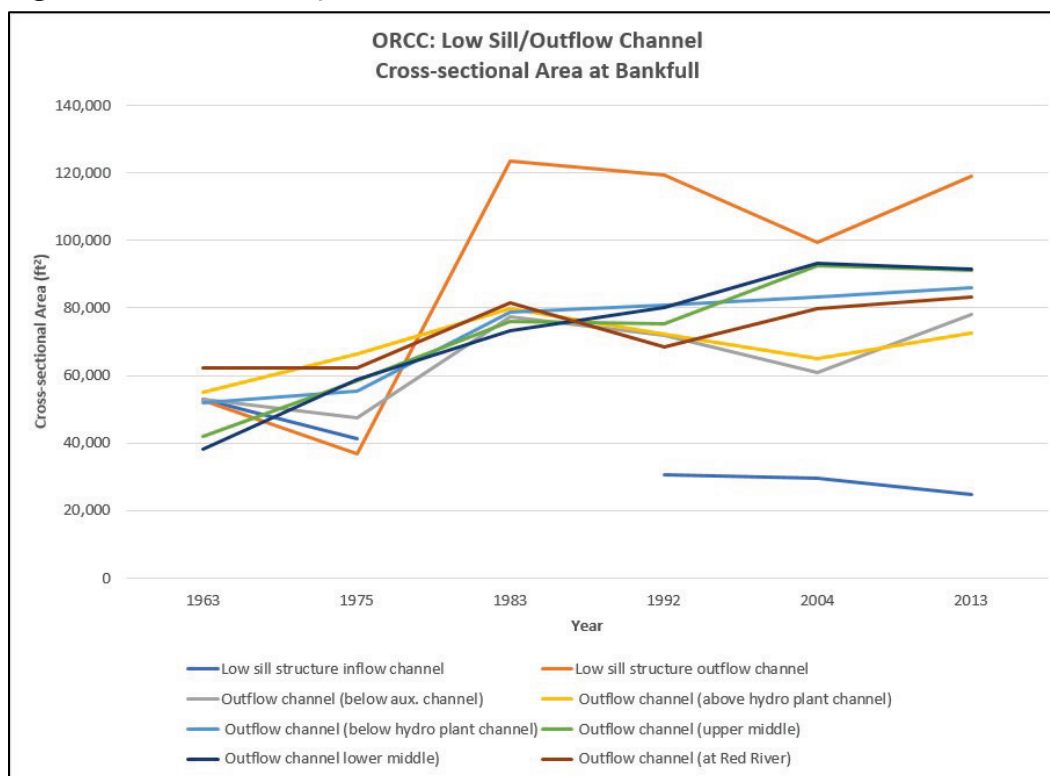
The plot of cross-sectional area at low water reference for the hydropower plant channel is shown in Figure 130. The plot indicates similar trends as those of the auxiliary structure, with increases in area observed from 1992 to 2004 following construction of the plant, and then relatively stable area to 2013. The sections in the middle and lower portions of the channel downstream of the power plant indicate the area is approximately three times that of the sections upstream of the structure, with the exception of the section immediately downstream of the power plant.

Figure 130. Hydropower plant channel, cross-sectional area at low water reference.



The plot of cross-sectional area at bankfull reference for the low sill and outflow channel is shown in Figure 131. In general, the trends are very similar to those for the low water referenced data. Cross-sectional area upstream of the low sill structure decreases over time, while the area downstream of the structure increases over time. Area immediately downstream of the low sill structure shows a significant increase from 1975 to 1983. The most notable trend is the consistent increase in area for the portion of the outflow channel that conveys the total ORCC discharge.

Figure 131. ORCC low sill/outflow channel, cross-sectional area at bankfull reference.



The plot of cross-sectional area at bankfull reference for the auxiliary structure channel is shown in Figure 132. Again, trends are very similar to those observed for the low water referenced data. Cross-sectional area for sections downstream of the auxiliary structure have been very stable.

The plot of cross-sectional area at bankfull reference for the hydropower plant channel is shown in Figure 133. As with the low sill structure and auxiliary structure, trends in cross-sectional area at bankfull reference are quite similar to those for the low water referenced data.

Figure 132. Auxiliary structure channel, cross-sectional area at bankfull reference.

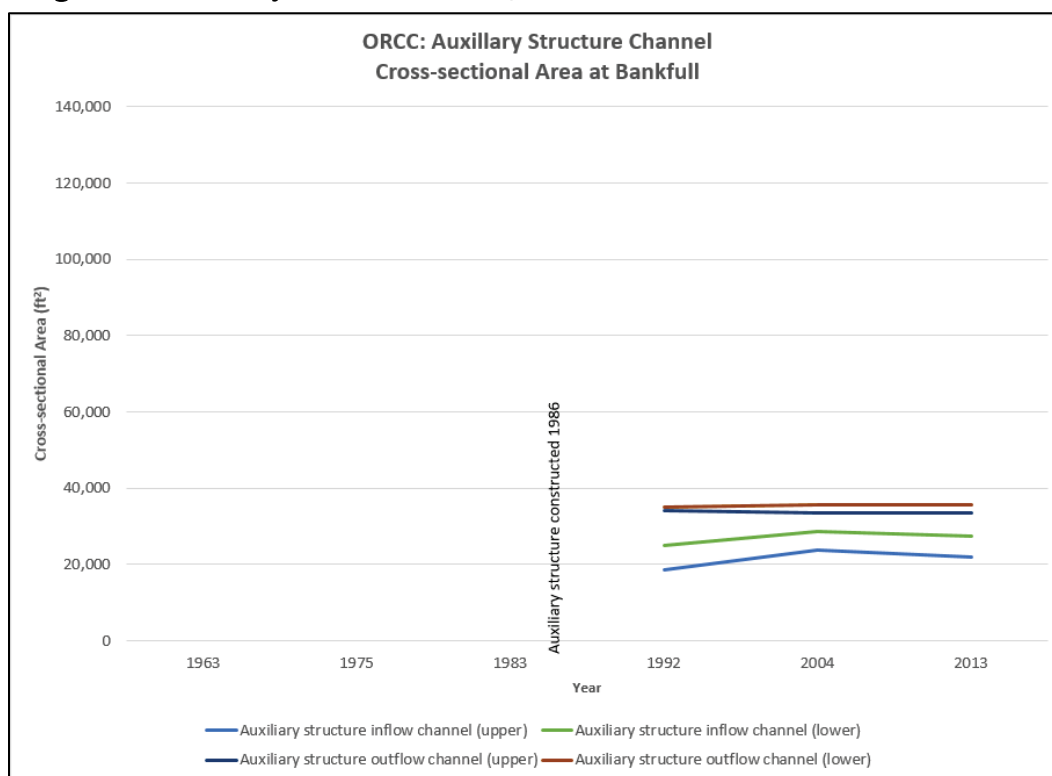
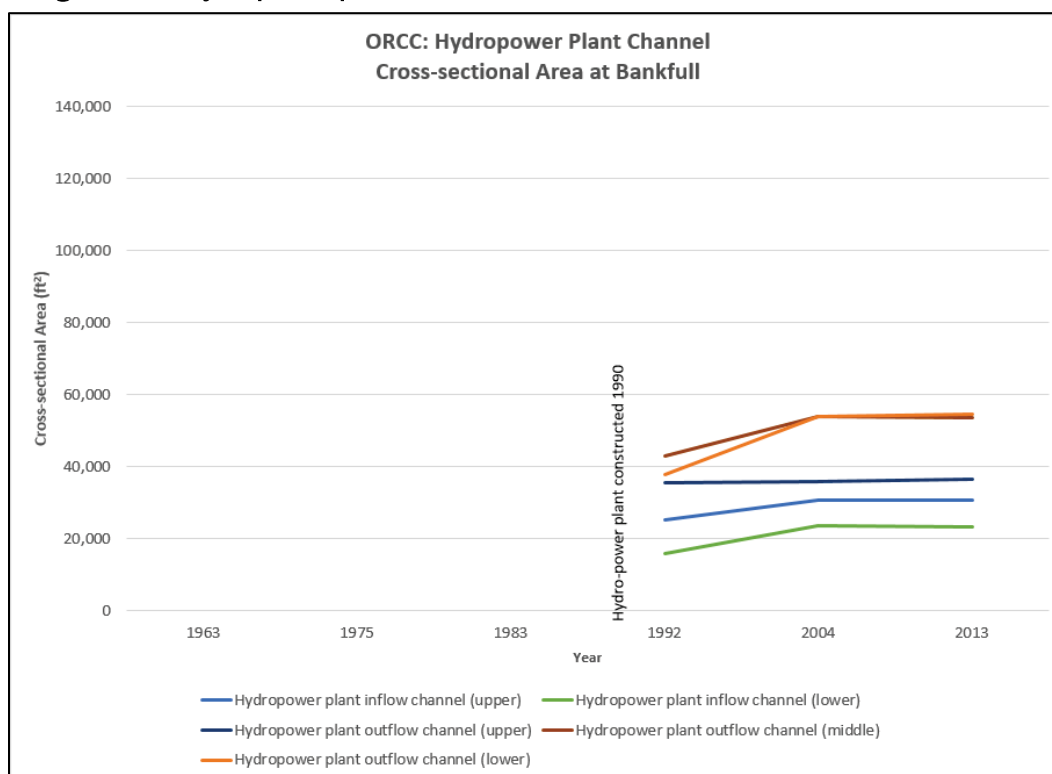


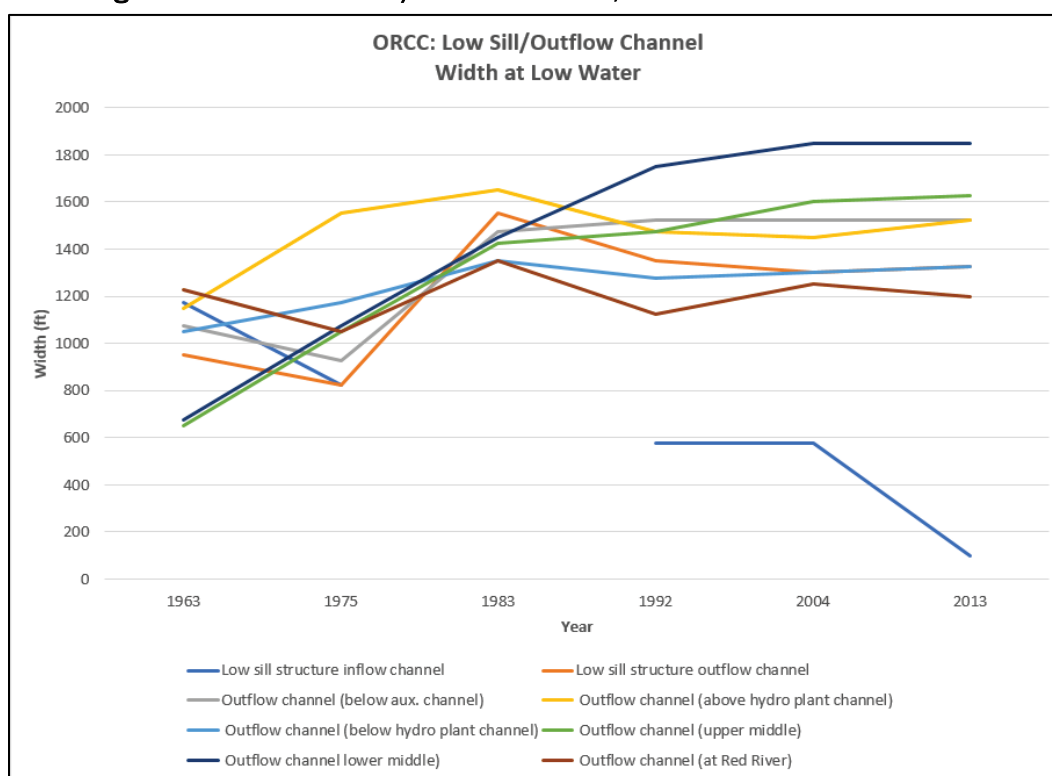
Figure 133. Hydropower plant channel, cross-sectional area at bankfull reference.



3.3.2 Width–Old River

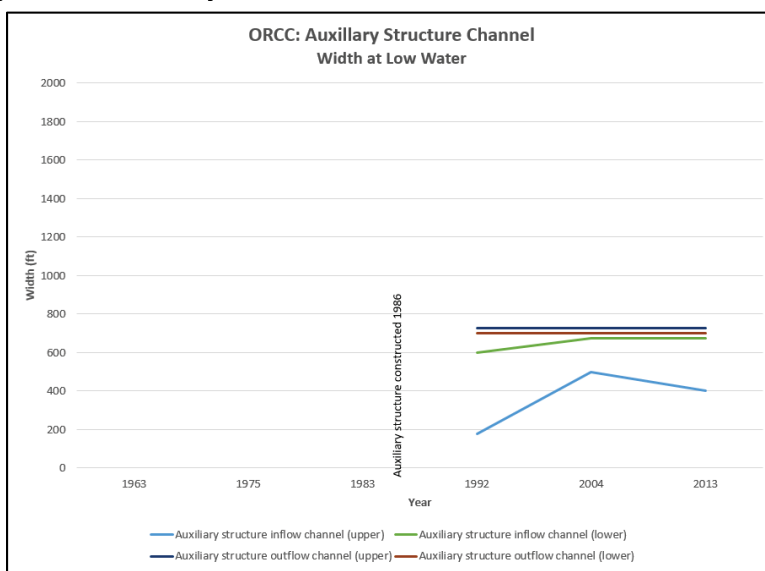
The plot of width at low water reference for the low sill and outflow channel is shown in Figure 134. Although there is variability in the data, the observed trend is increase in channel width for all sections over the survey time periods, with the exception of the section upstream of the low sill structure. The section upstream of the structure indicates a general decreasing trend in width. Sections downstream of the structure indicate initial increases in width, with relatively stable widths from 2004 to 2013.

Figure 134. ORCC low sill/outflow channel, width at low water reference.



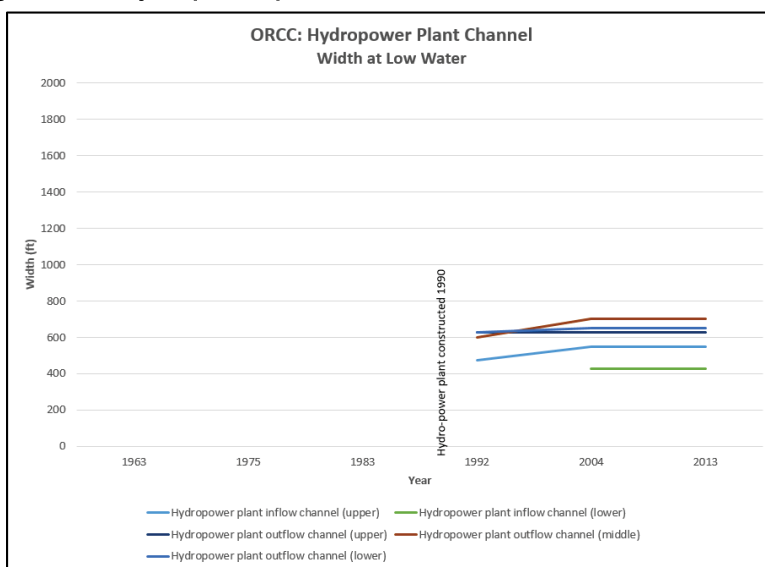
The plot of width at low water reference for the auxiliary structure channel is shown in Figure 135. With the exception of the section upstream of the structure nearest the Mississippi River, the width for all sections is relatively stable for all survey time periods.

Figure 135. Auxiliary structure channel, width at low water reference.



The plot of width at low water reference for the hydropower plant channel is shown in Figure 136. All sections for the power plant channel indicate a relatively stable width, with slight increases in width observed following construction of the power plant, followed by stable widths for the most recent survey periods.

Figure 136. Hydropower plant channel, width at low water reference.



The plot of channel width at bankfull reference for the low sill and outflow channel, the auxiliary structure channel, and the hydropower plant channel is shown in Figures 137 through 139. In general, observed trends in channel width for all sections are similar to those for the low water referenced data. Likewise, channel widths at bankfull reference for these sections have been relatively stable over the survey periods.

Figure 137. ORCC low sill/outflow channel, width at bankfull reference.

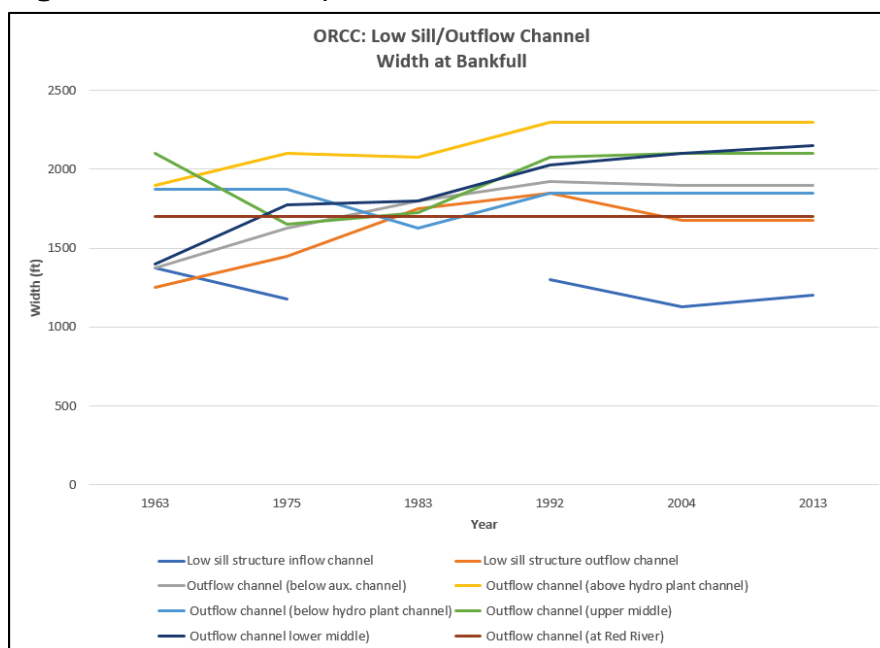


Figure 138. Auxiliary structure channel, width at bankfull reference.

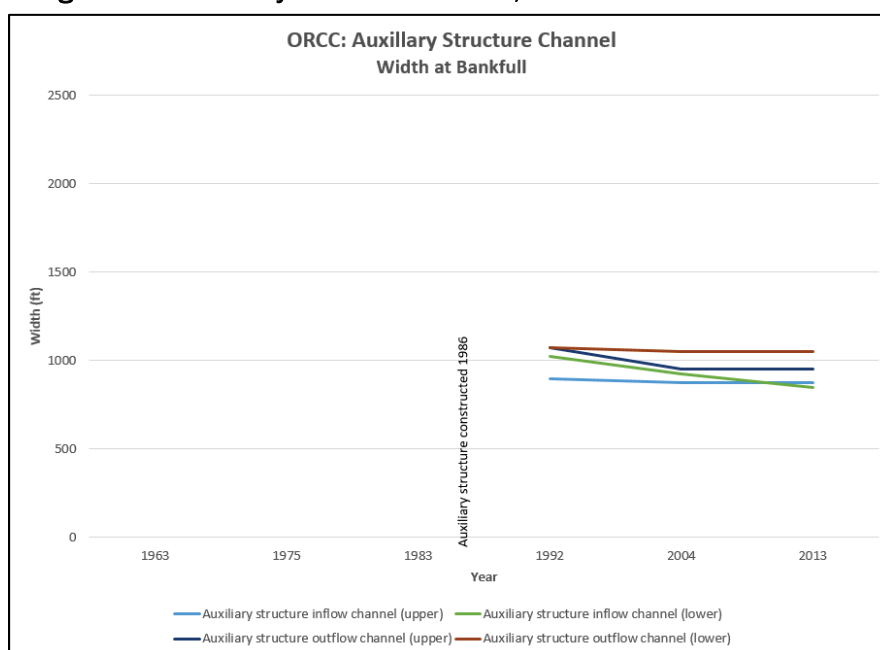
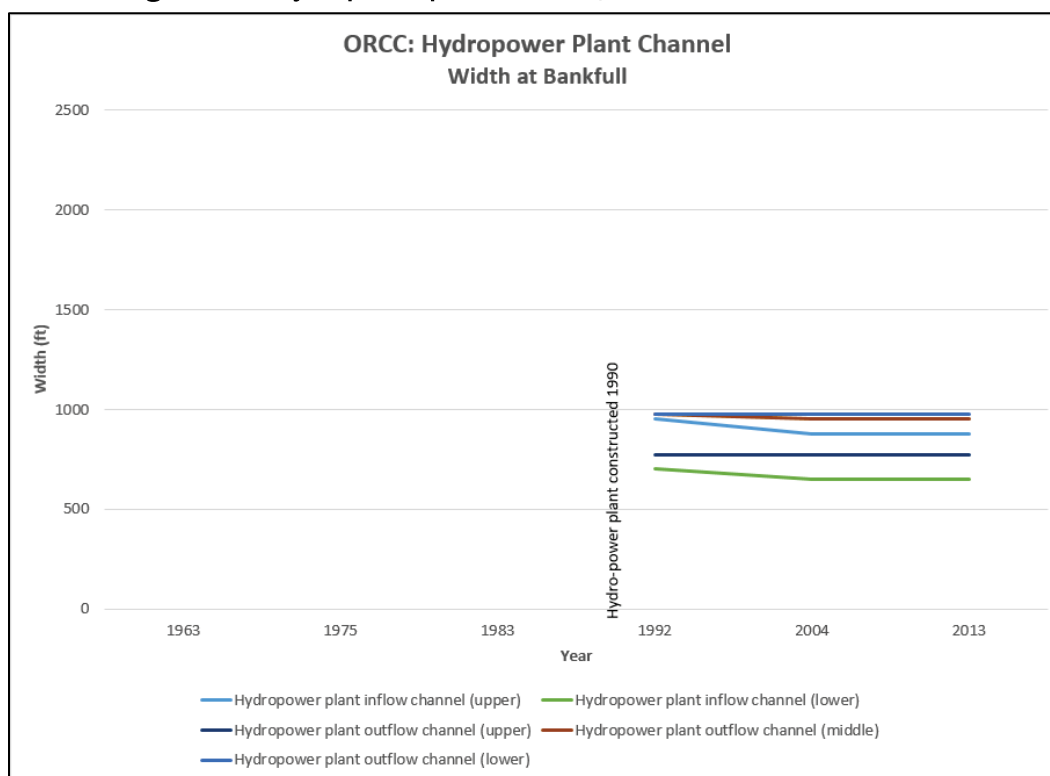


Figure 139. Hydropower plant channel, width at bankfull reference.



3.3.3 Hydraulic depth–Old River

The plots of hydraulic depth at low water reference for the low sill and outflow channel, the auxiliary structure channel, and the hydropower plant channel are shown in Figures 140 through 142. Generally, the hydraulic depth trends are similar to those observed for the cross-sectional area. This is reasonable, since the widths in the denominator of the hydraulic depth computation were fairly constant, as discussed in the previous section. The trend in hydraulic depth for the low sill and outflow channel indicate decreasing hydraulic depth upstream of the structure, and generally increasing hydraulic depth in the outflow channel downstream of the low sill structure. Trends in hydraulic depth for the auxiliary structure and hydropower plant channels indicate increase in hydraulic depth for the period following structure construction, followed by relatively stable depths for subsequent survey periods.

Figure 140. ORCC low sill/outflow channel, hydraulic depth at low water reference.

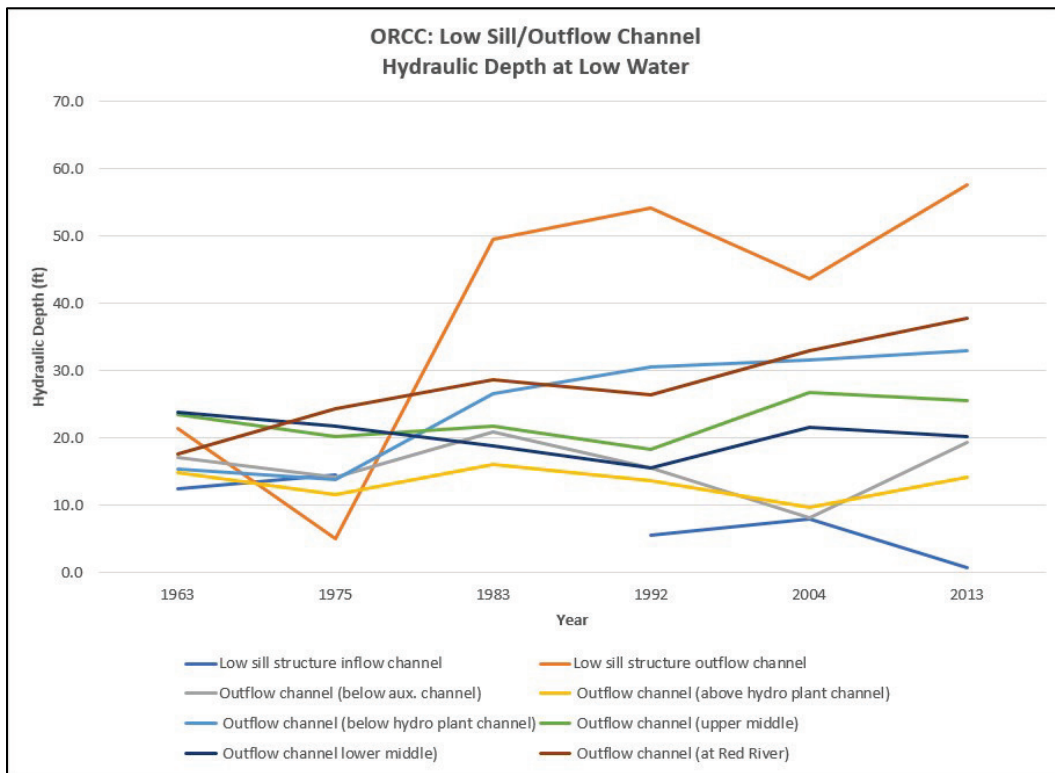


Figure 141. Auxiliary structure channel, hydraulic depth at low water reference.

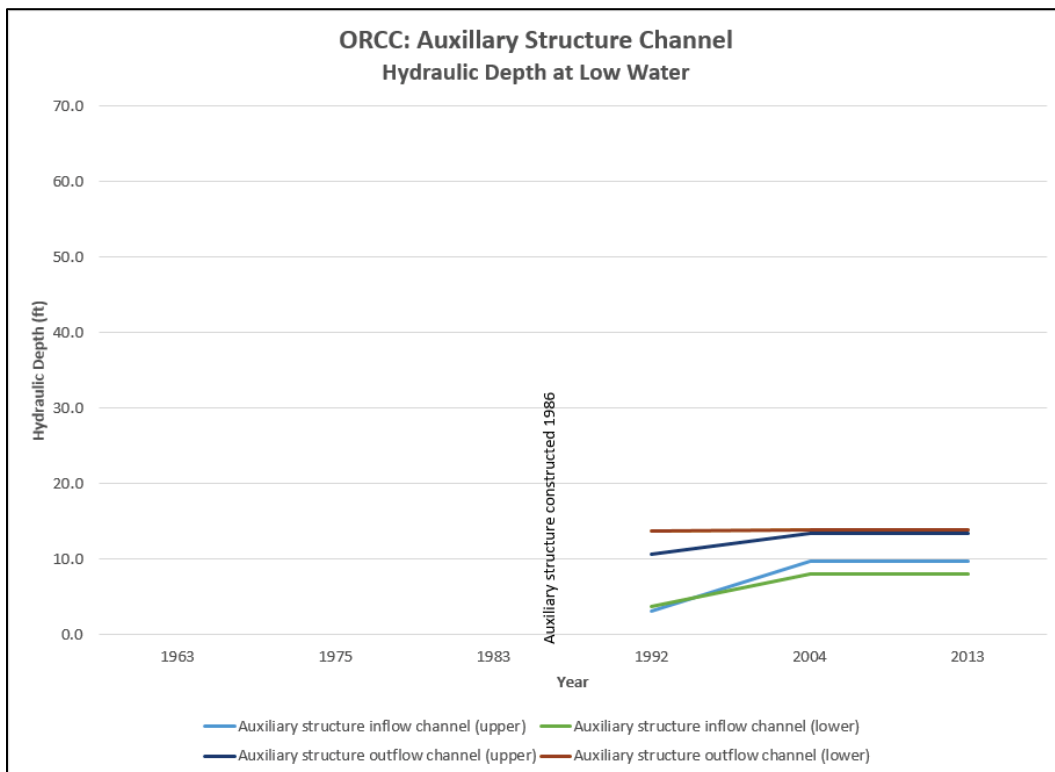
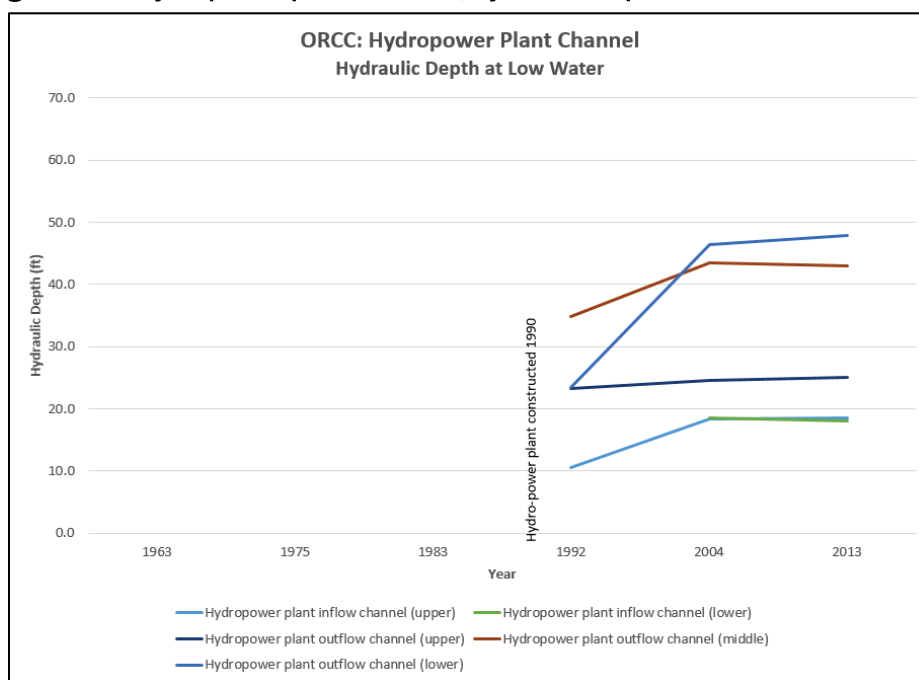


Figure 142. Hydropower plant channel, hydraulic depth at low water reference.



The plots of hydraulic depth at bankfull reference for the low sill and outflow channel, the auxiliary structure channel and the hydropower plant channel are shown in Figures 143 through 145. In general, observed trends in hydraulic depth for all sections are similar to those for the low water referenced data.

Figure 143. ORCC low sill/outflow channel, hydraulic depth at bankfull reference.

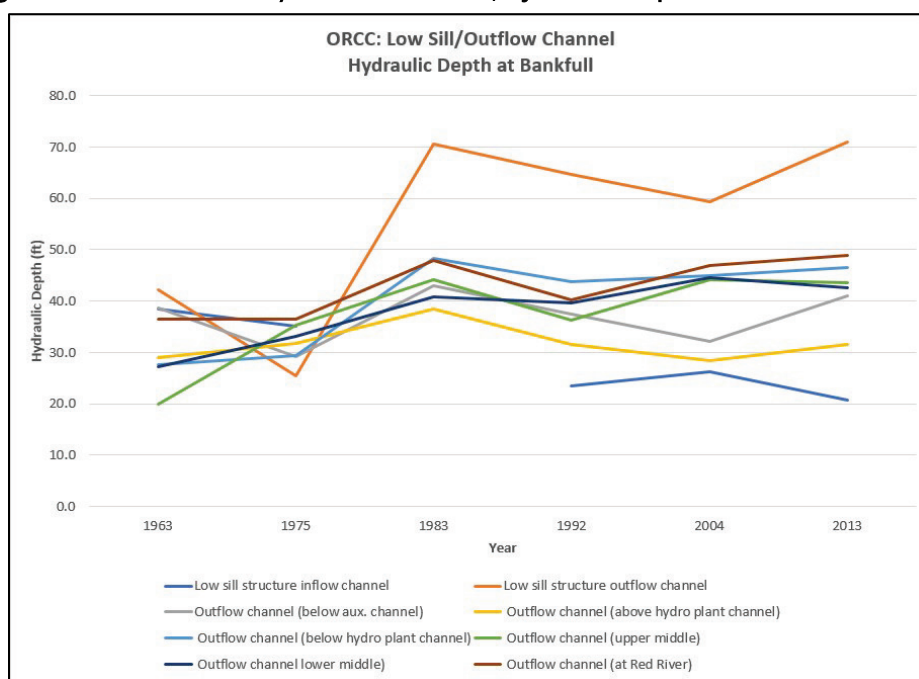


Figure 144. Auxiliary structure channel, hydraulic depth at bankfull reference.

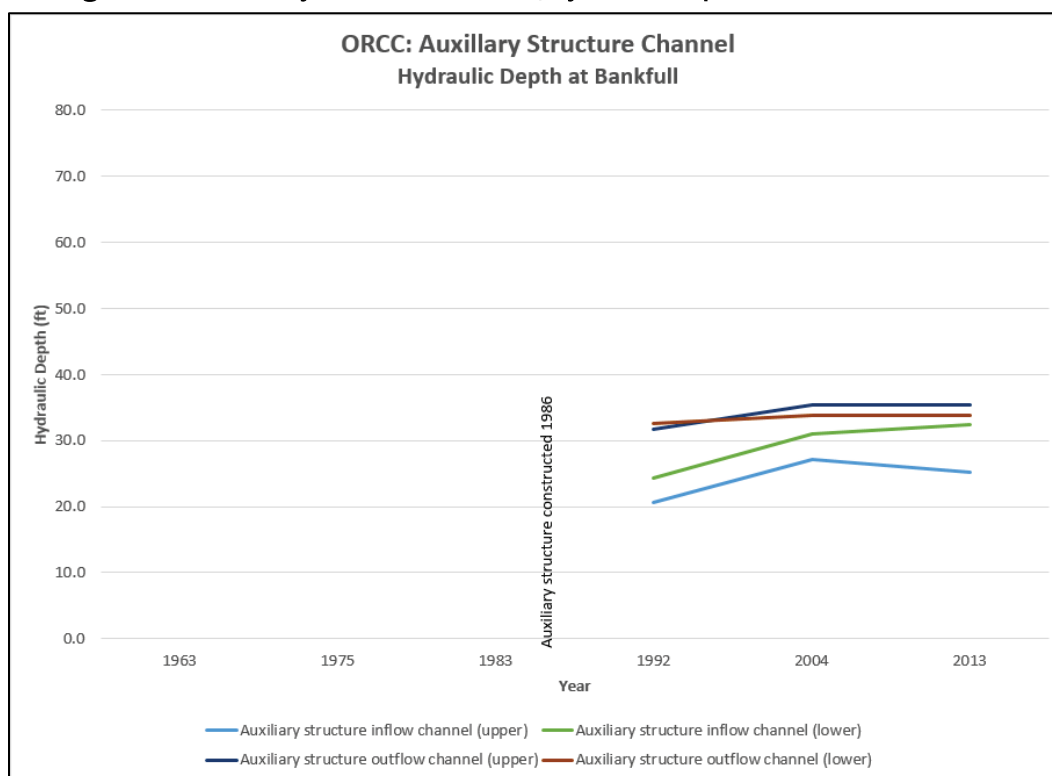


Figure 145. Hydropower plant channel, hydraulic depth at bankfull reference.

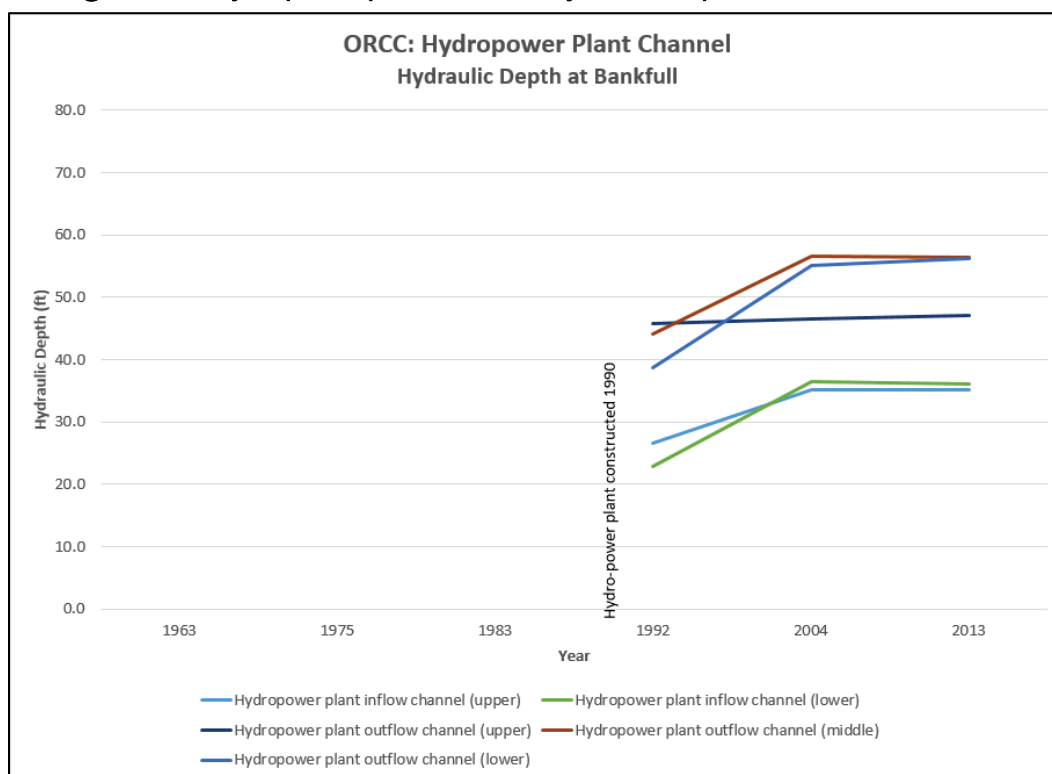


Figure 147. Auxiliary structure channel, conveyance at low water reference.

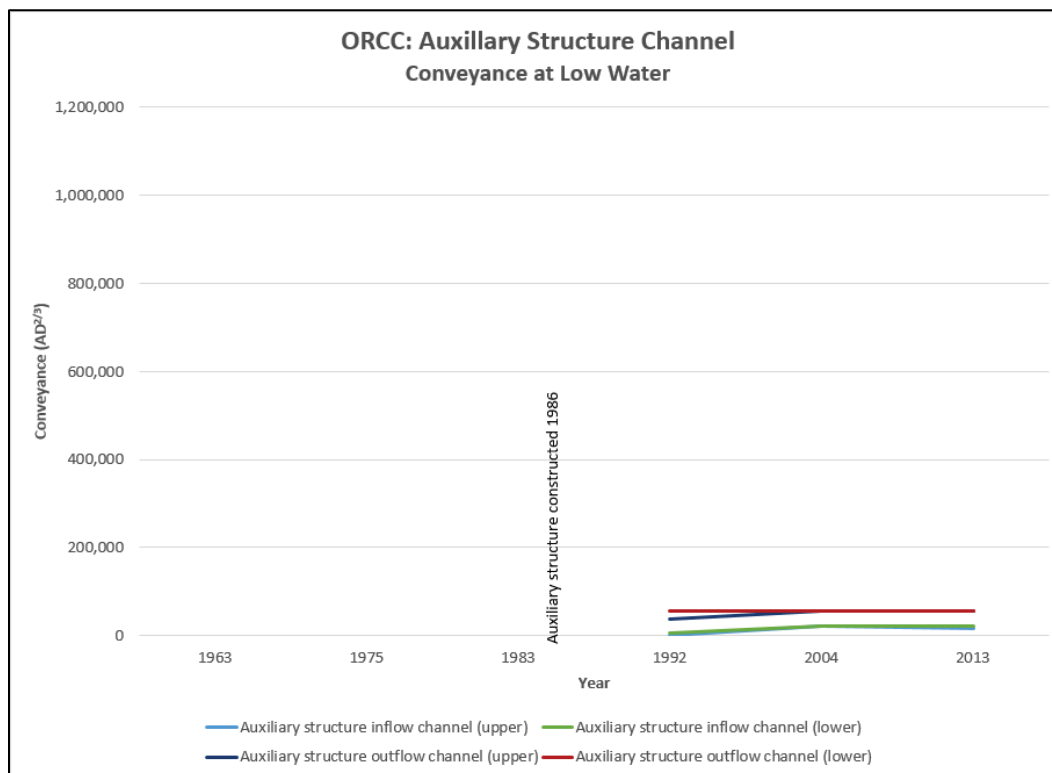


Figure 148. Hydropower plant channel, conveyance at low water reference.

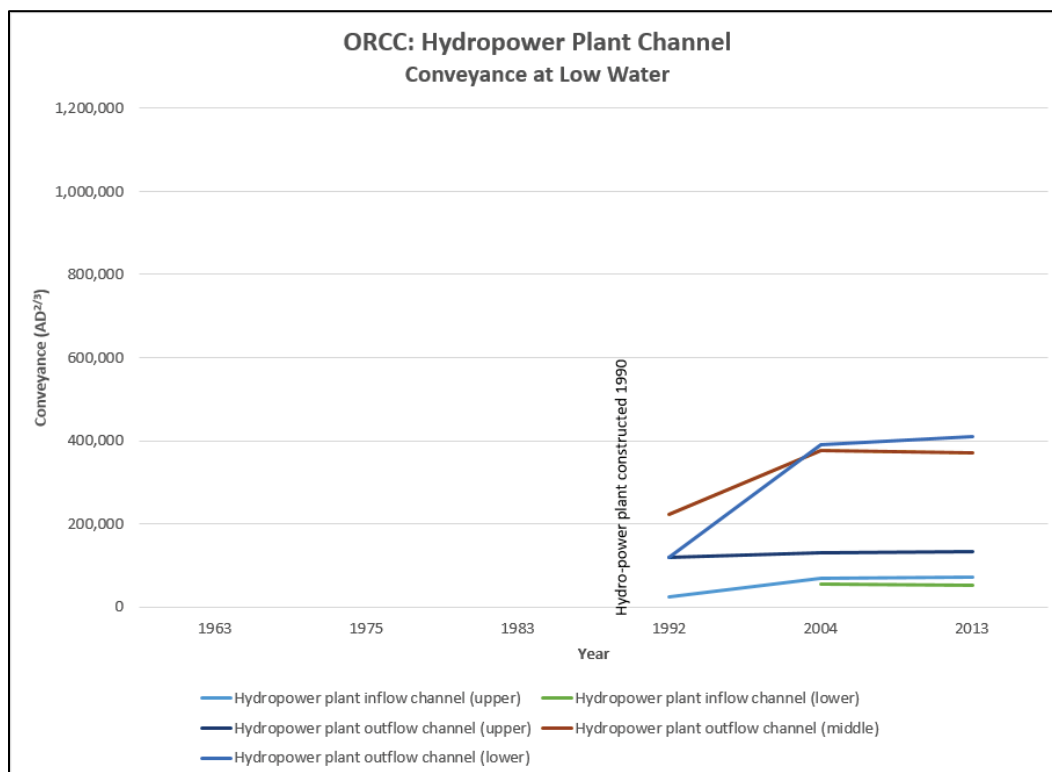


Figure 149. ORCC low sill/outflow channel, conveyance at bankfull reference.

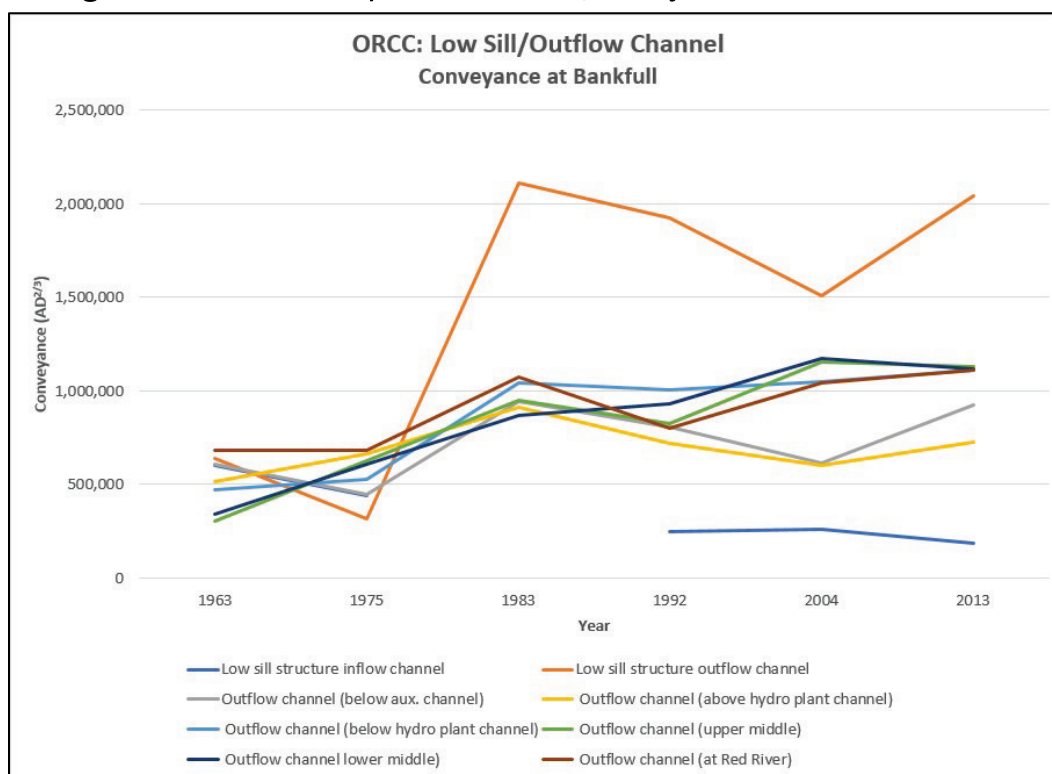


Figure 150. Auxiliary structure channel, conveyance at bankfull reference.

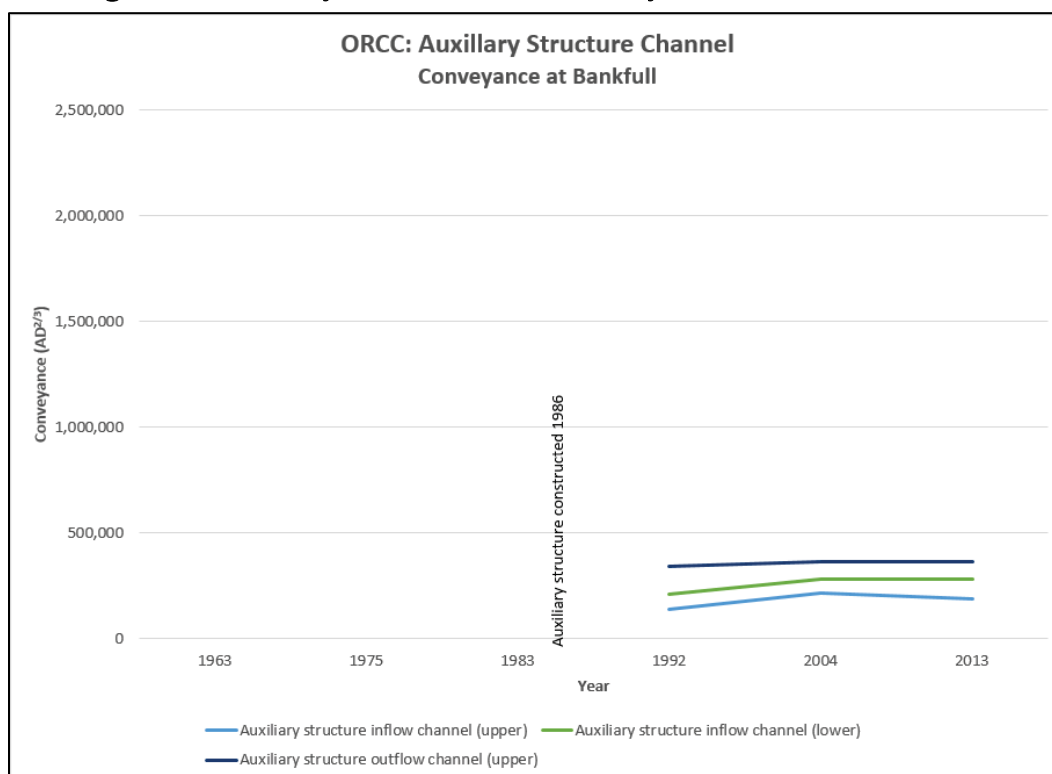
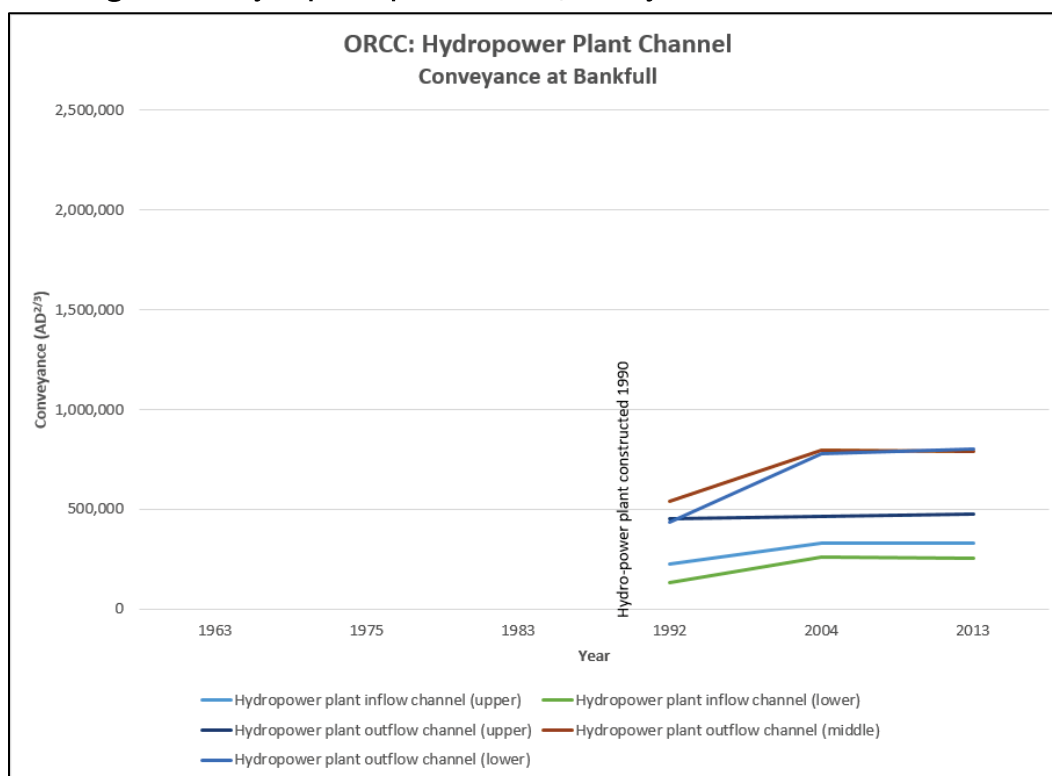


Figure 151. Hydropower plant channel, conveyance at bankfull reference.



3.3.5 W/D-Old River

The plots of W/D ratio at low water reference for the low sill and outflow channel, the auxiliary structure channel, and the hydropower plant channel are shown in Figures 152 through 154. The plot of W/D ratio for the low sill outflow channel shown in Figure 152 indicates a considerable degree of variability with no discernable long-term trends. The plots for the auxiliary structure and hydropower plant shown in Figures 153 and 154 indicate a range in trends from decreasing ratio immediately following structure construction to relatively stable ratios for subsequent survey time periods.

Figure 152. ORCC low sill/outflow channel, W/D ratio at low water reference.

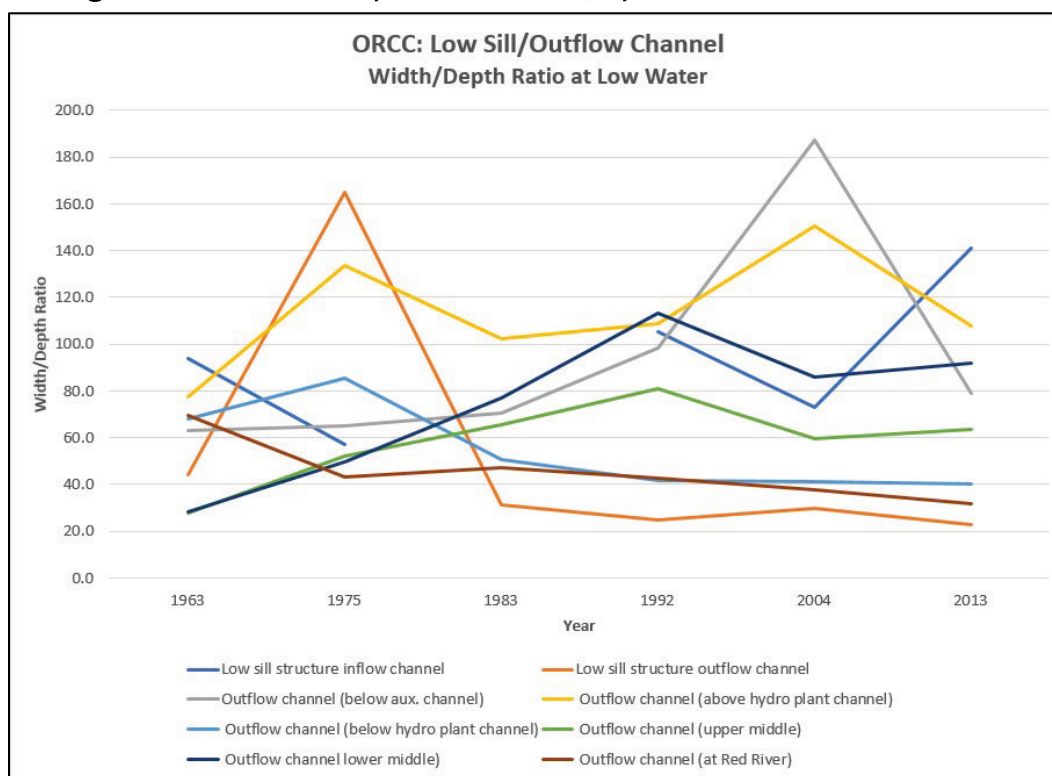


Figure 153. Auxiliary structure channel, W/D ratio at low water reference.

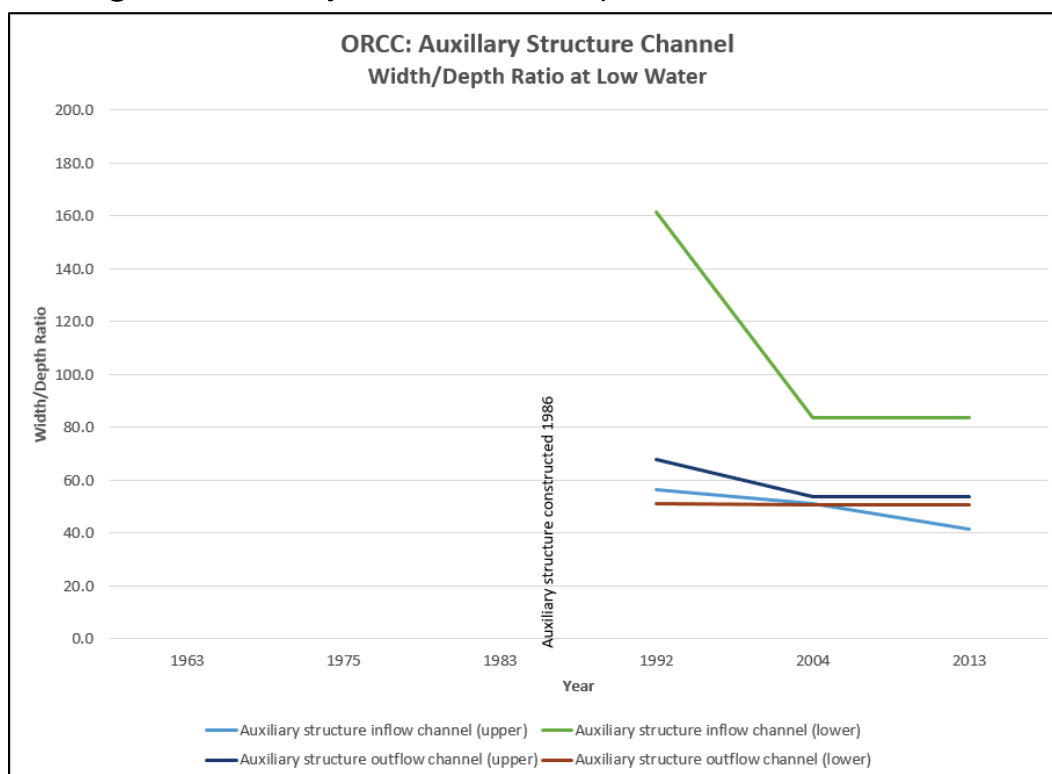
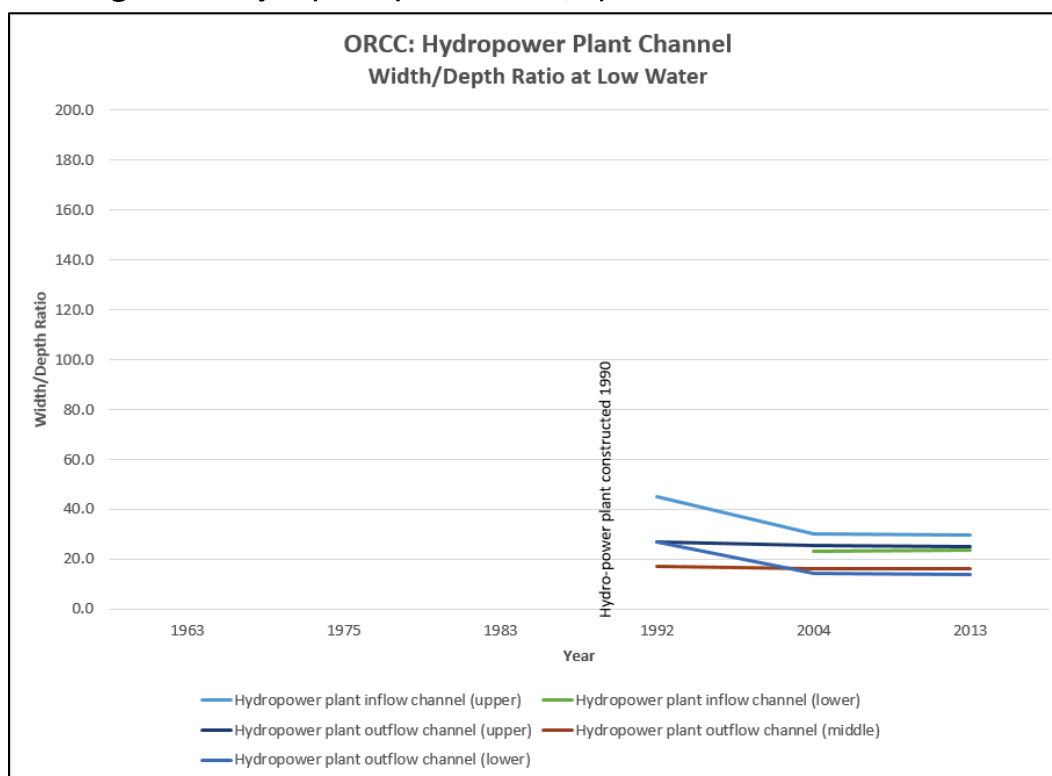


Figure 154. Hydropower plant channel, W/D ratio at low water reference.



The trends for W/D ratio referenced to bankfull conditions are very similar to those observed for ratios referenced to low water. The plots of W/D ratio at bankfull reference for the low sill and outflow channel, the auxiliary structure channel, and the hydropower plant channel are shown in Figures 155 through 157. Figure 155 indicates the W/D ratio at bankfull is highly variable, with no definitive trends observed. Figures 156 and 157 indicate the W/D ratio for the auxiliary structure and hydropower plant follow trends of decreasing ratio in the period immediately following structure construction, followed by a relatively stable trend in subsequent survey time periods.

Figure 155. ORCC low sill/outflow channel, W/D ratio at bankfull reference.

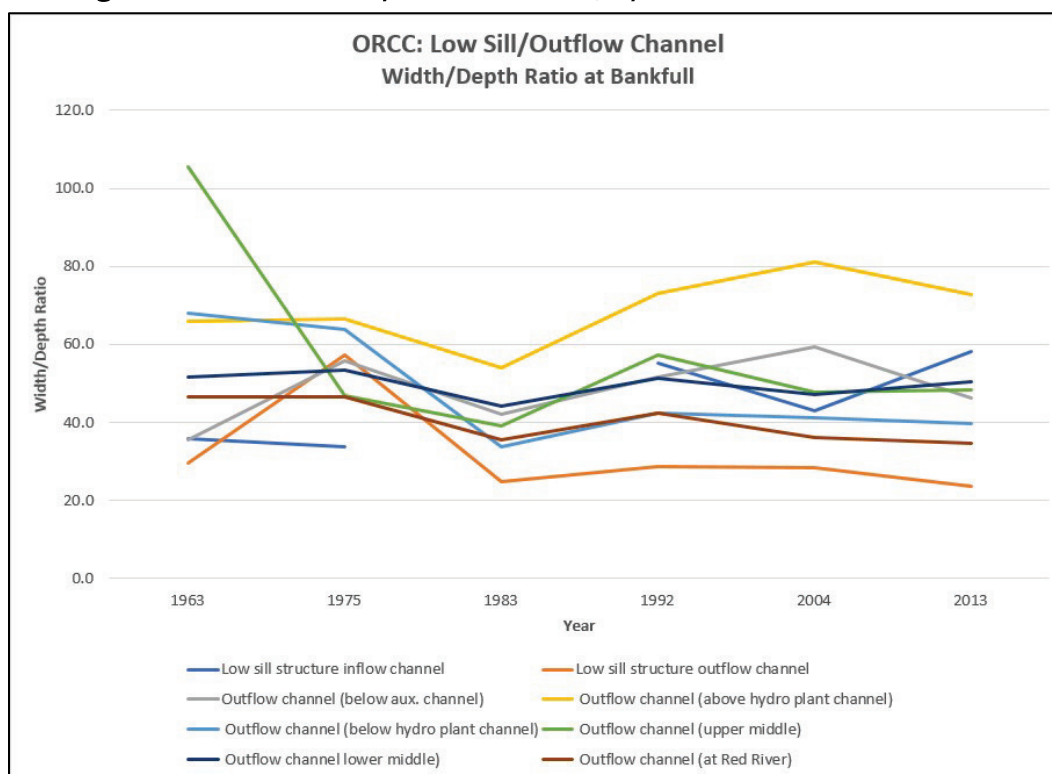


Figure 156. Auxiliary structure channel, W/D ratio at bankfull reference.

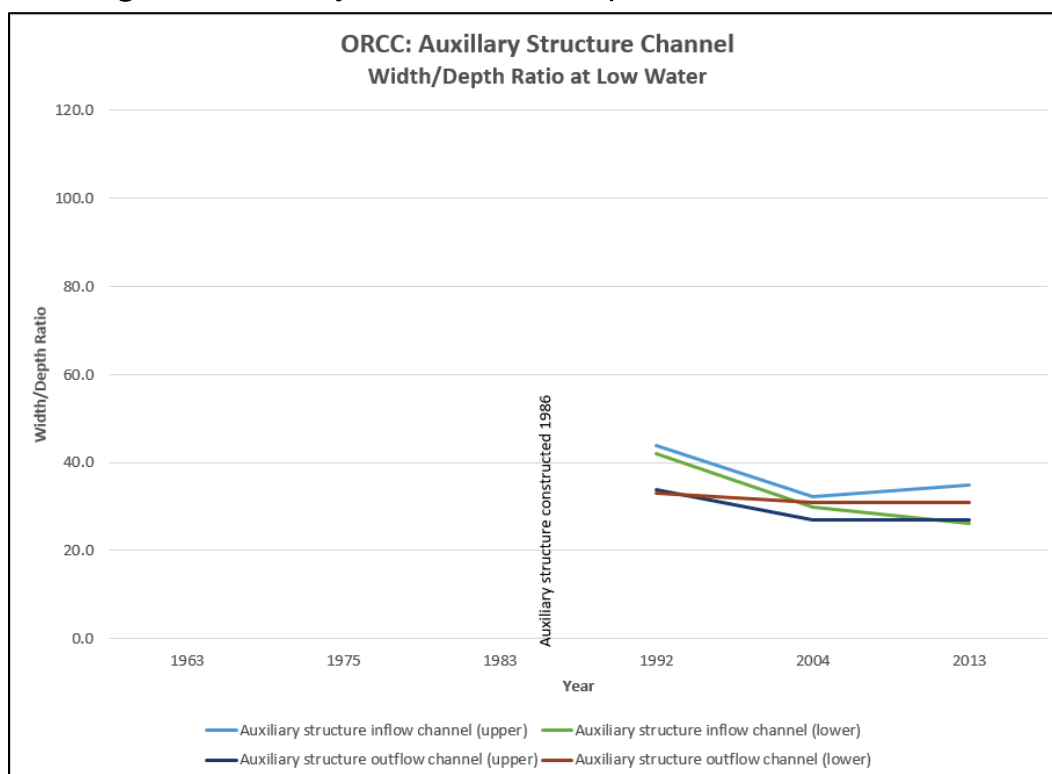
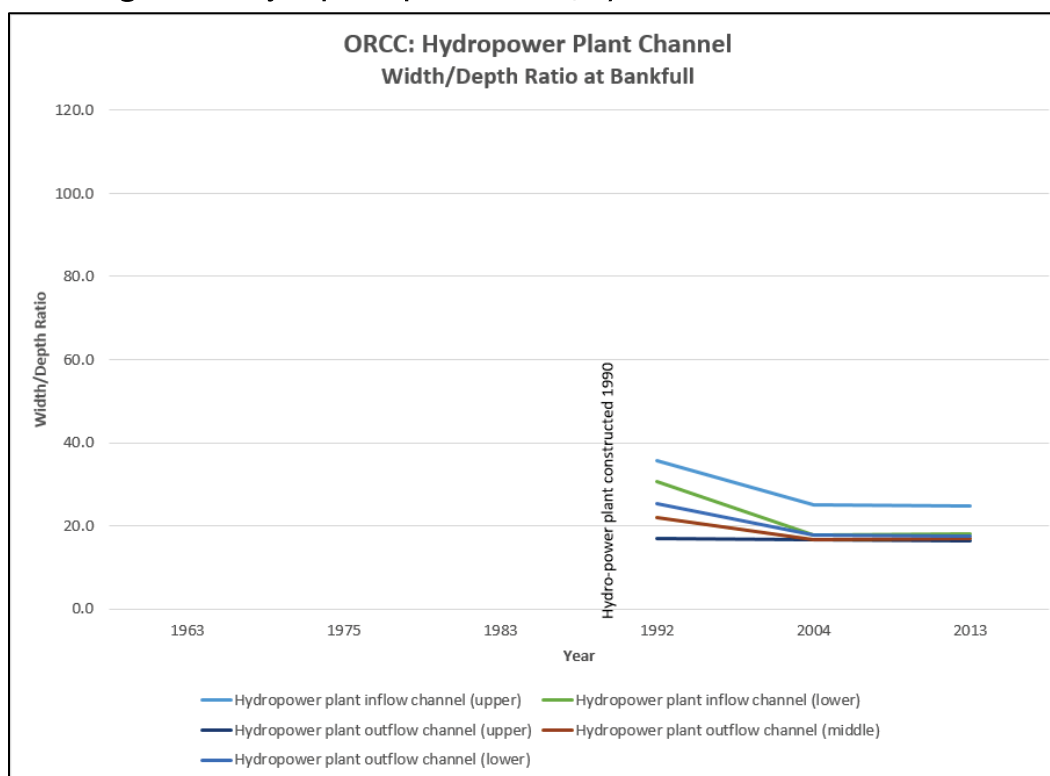


Figure 157. Hydropower plant channel, W/D ratio at bankfull reference.



3.4 Volumetric analyses

Channel volumes relative to the low water and bankfull reference planes were computed in acre-feet for 1 mi segments of the Mississippi River and Atchafalaya River. Channel volumes for Old River were computed for each geomorphic segment due to the short extents of the reaches. The 1 mi segments for which the volumes were computed have widths that generally span the main channel within the top banks of the channel. Box-and-whisker plots and trend plots were developed for each geomorphic reach to illustrate trends in the central tendency of the data sets and trends in average median values for each reach. The observed trends in the median value of channel volume give insight into the net channel erosion and deposition for each reach. Decreasing trends in median values of channel volume indicate net deposition during the period, while trends of increasing values indicate net erosion.

3.4.1 Volumetric analysis—Mississippi River

The box-and-whisker plots of channel volume at low water reference for the Mississippi River geomorphic reaches are shown in Figures 158 through

160. For the Baton Rouge to ORCC reach shown in Figure 158, a generally decreasing trend in median channel volume (deposition) is noted from 1915 to 1975. From 1975 to 2013 there is slight variability, but a steady to slightly decreasing trend in median volume is observed, indicating dynamic equilibrium to slight deposition. The plot for the ORCC-to-Natchez reach shown in Figure 159 indicates a variable but generally stable trend in median volume from 1915 to 1988, followed by a slightly decreasing trend (deposition) from 1988 to 2013. Note that the IQR is highly variable from survey to survey. For the Natchez-to-Vicksburg geomorphic reach shown in Figure 160, a sharp decreasing trend in median volume is observed from 1915 to 1948, followed by a slight increasing trend in volume (erosion) from 1948 to 1975, then a slightly decreasing to stable trend from 1975 to 2013. The sharp decrease noted from 1915 to 1948 is interesting, but the reason for the sharp reduction in median volume is uncertain. One possible reason is the deposition of excessive material eroded from reaches upstream of Vicksburg as a result of numerous cut-offs of Mississippi River during the 1930s and early 1940s.

Figure 158. Mississippi River Baton Rouge to ORCC, channel volume at low water reference.

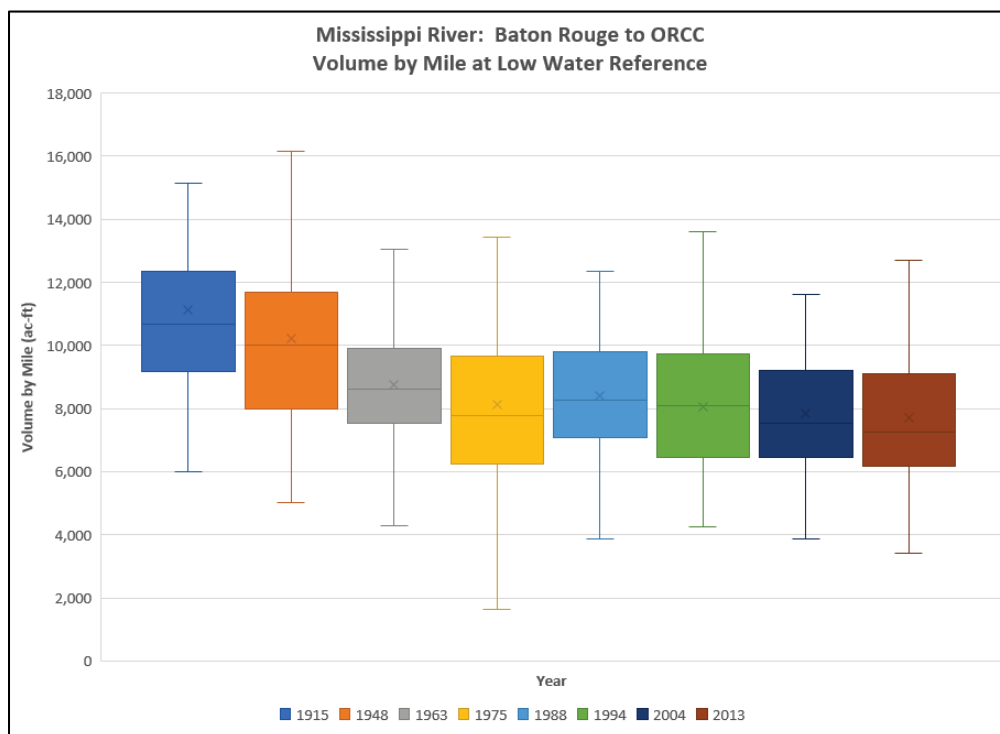


Figure 159. Mississippi River ORCC to Natchez, channel volume at low water reference.

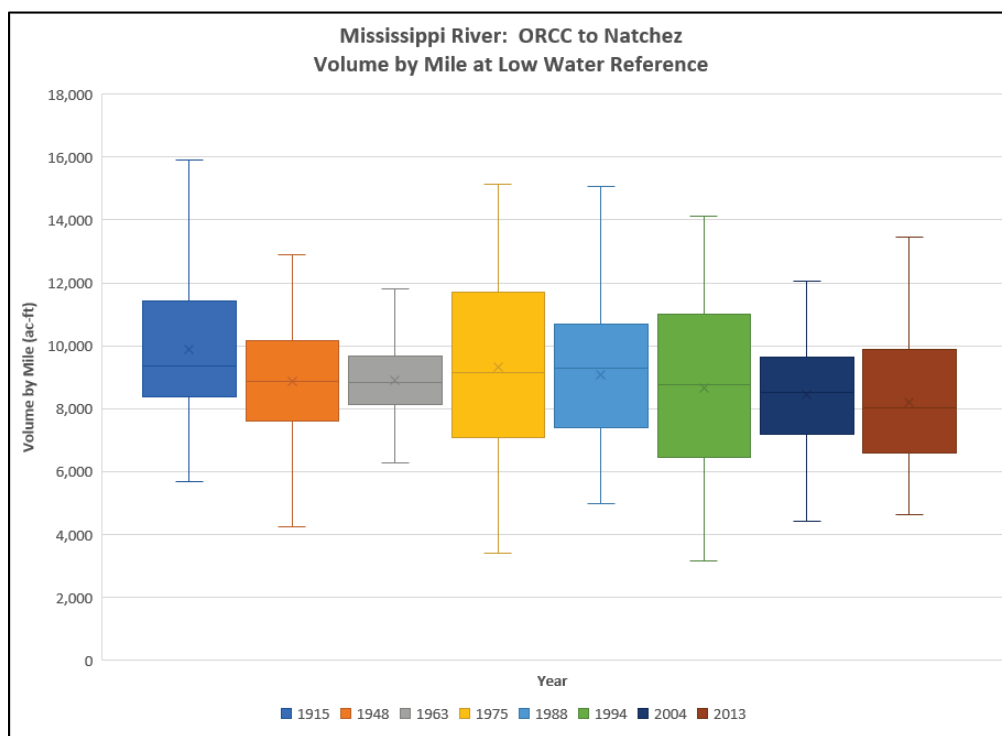
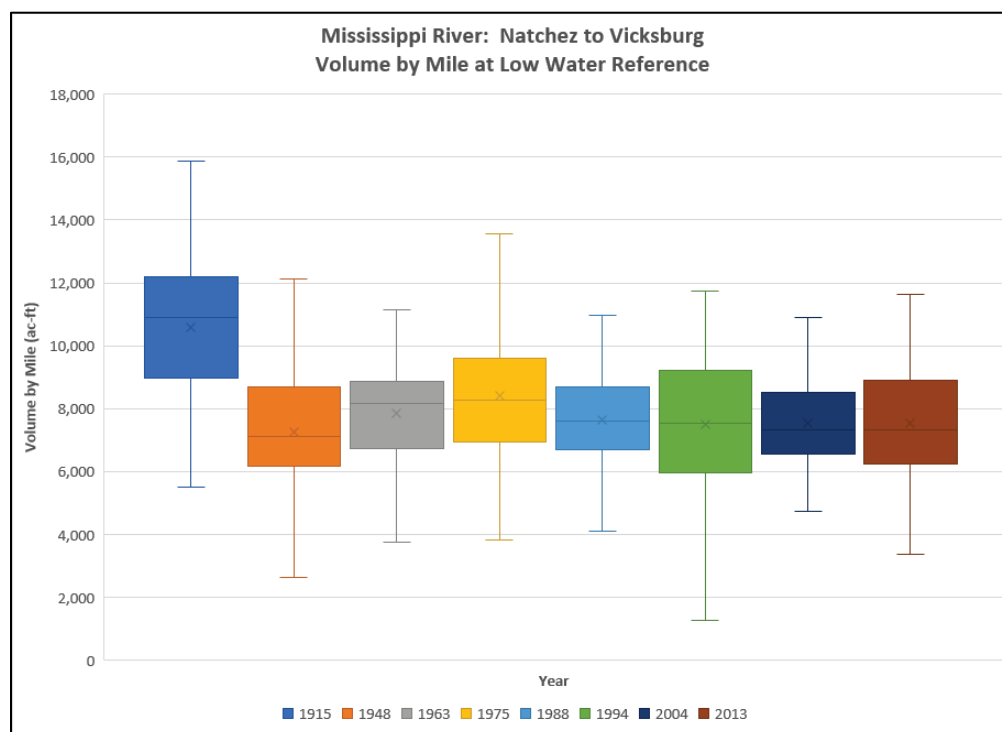


Figure 160. Mississippi River Natchez to Vicksburg, channel volume at low water reference.



The trend plots of median channel volume at the LWRP for the Mississippi River geomorphic reaches are shown in Figures 161 through 163. In general, the trend plots illustrate the same tendencies as those noted by the box-and-whisker plots. Note that the trends in median volume for all three reaches from approximately 1975 to 2013 are mildly variable but generally stable, indicating these reaches are possibly near some state of dynamic equilibrium but are still adjusting slightly. Also note that this adjustment in median volume is slightly but consistently decreasing (deposition) from approximately 1988 to 2013 for the Baton Rouge-to-ORCC and ORCC-to-Natchez reaches but is less decreasing to relatively stable for the Natchez-to-Vicksburg reach.

Figure 161. Mississippi River Baton Rouge to ORCC, trend plot of channel volume at low water reference.

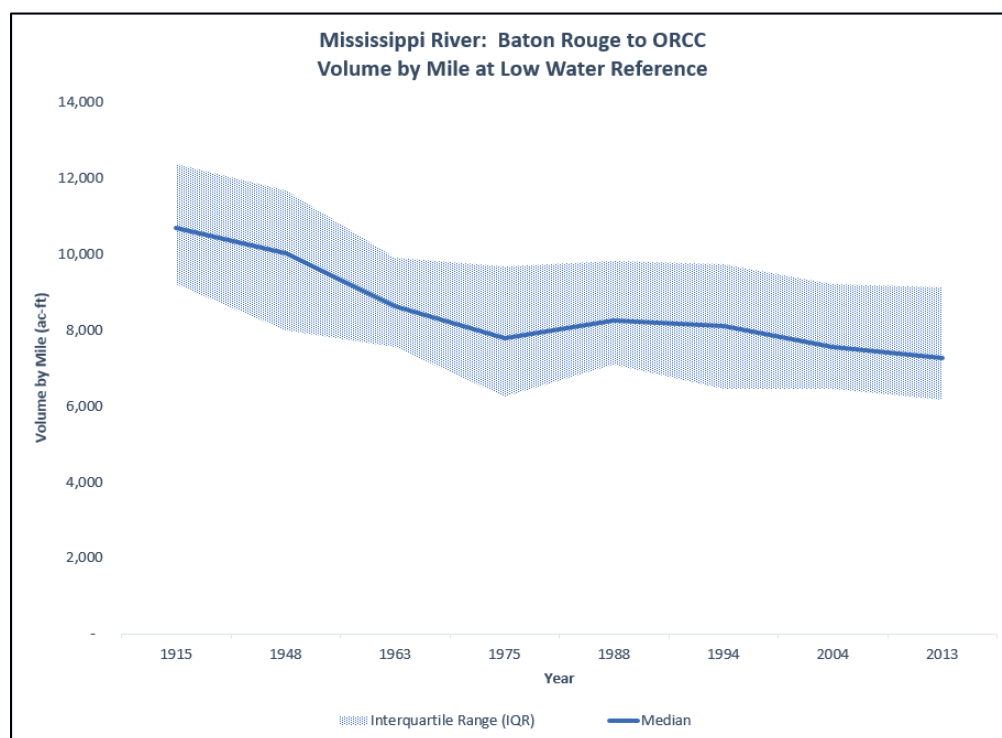


Figure 162. Mississippi River ORCC to Natchez, trend plot of channel volume at low water reference.

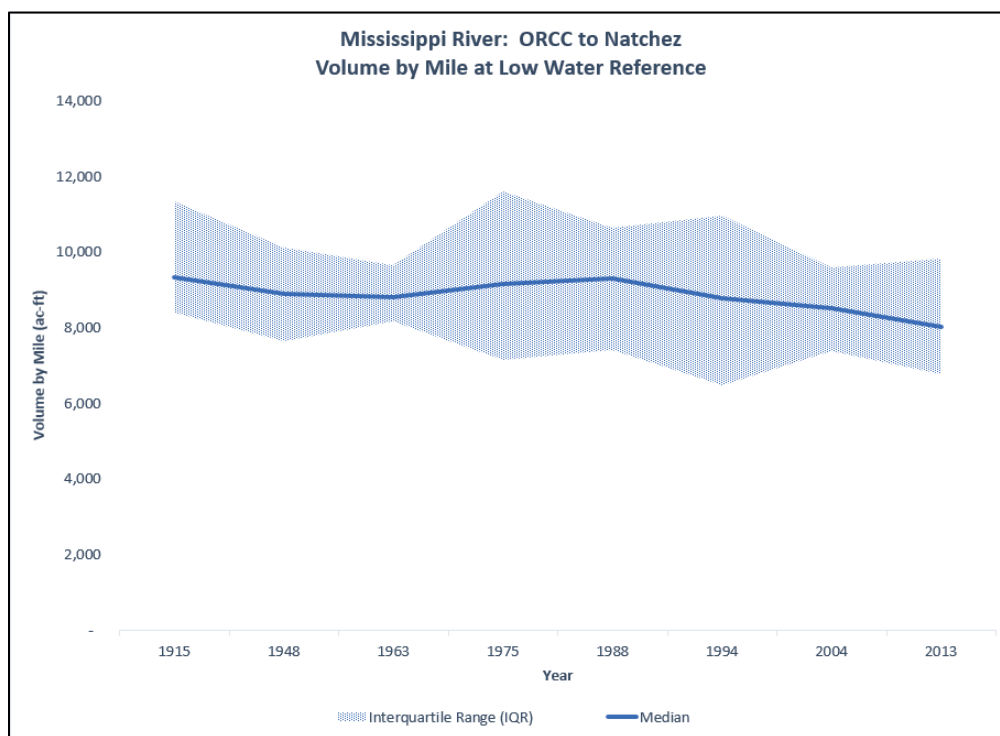
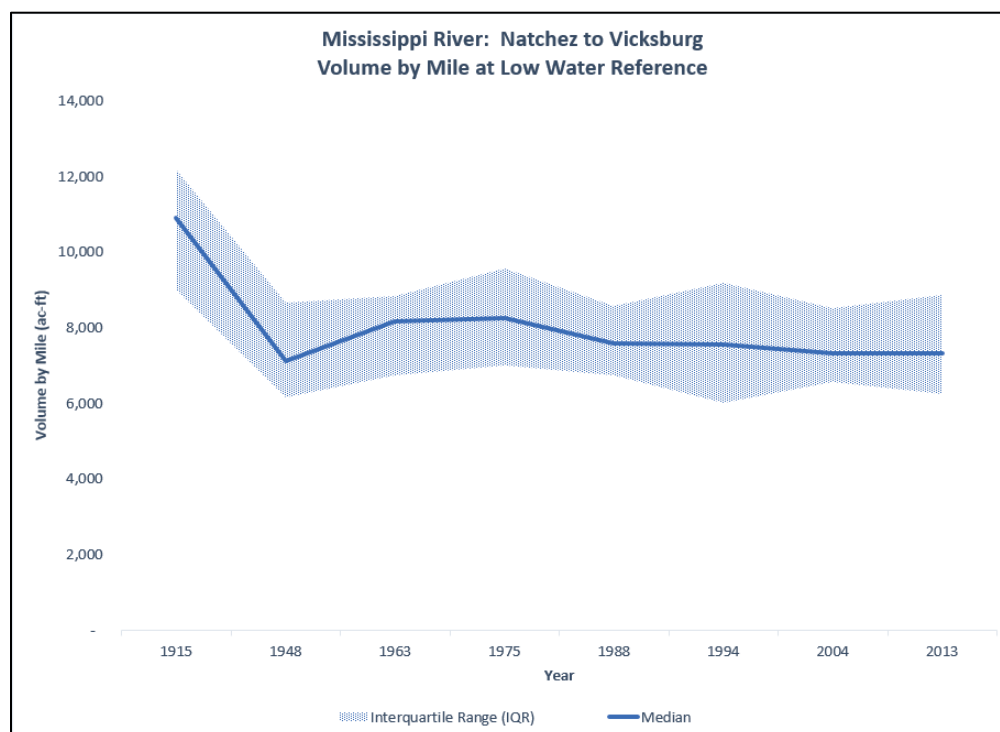


Figure 163. Mississippi River Natchez to Vicksburg, trend plot of channel; volume at low water reference.



The box-and-whisker plots and trend plots of channel volume at bankfull conditions (LWRP+25) for the Mississippi River geomorphic reaches are shown in Figures 164 through 166 and Figures 167 through 169, respectively. In general, the trends for bankfull conditions are very similar to those observed for the low water reference.

Figure 164. Mississippi River Baton Rouge to ORCC, channel volume at bankfull reference.

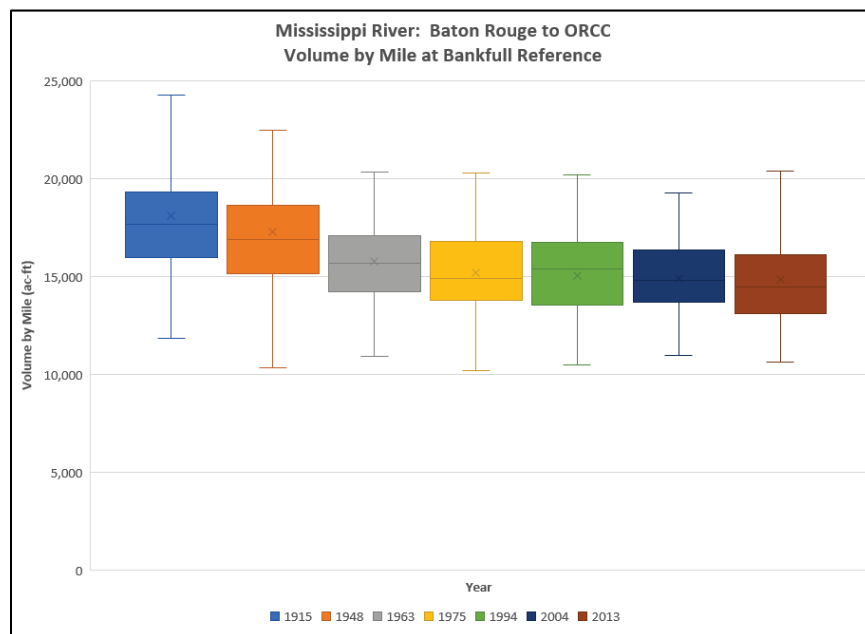


Figure 165. Mississippi River ORCC to Natchez, channel volume at bankfull reference.

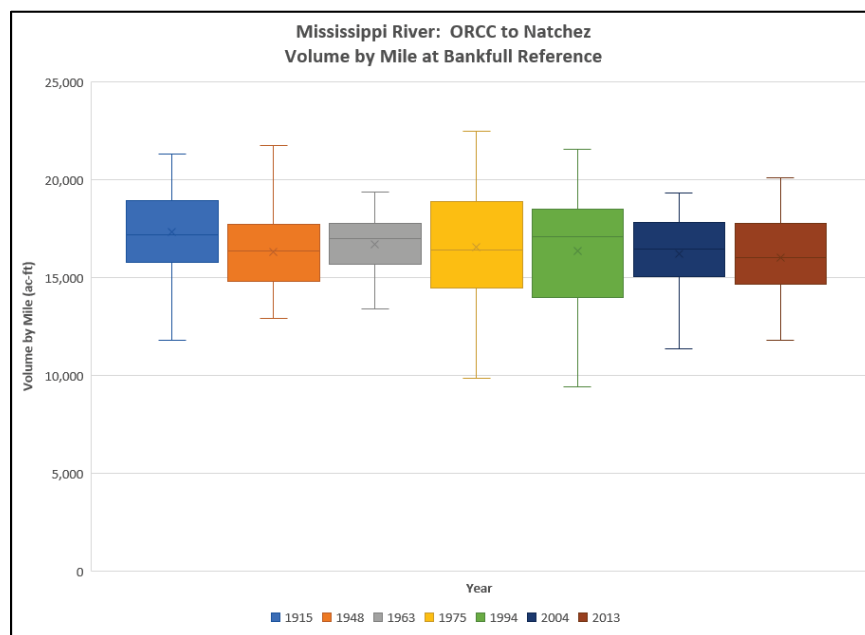


Figure 166. Mississippi River Natchez to Vicksburg, channel volume at bankfull reference.

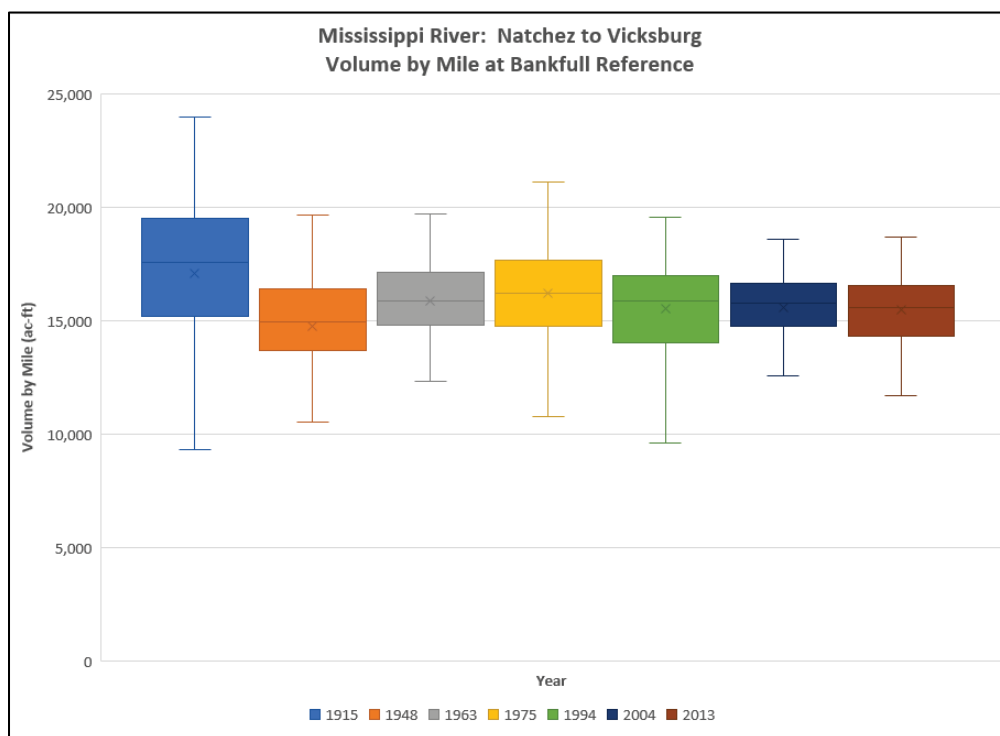


Figure 167. Mississippi River Baton Rouge to ORCC, trend plot of channel volume at bankfull reference.

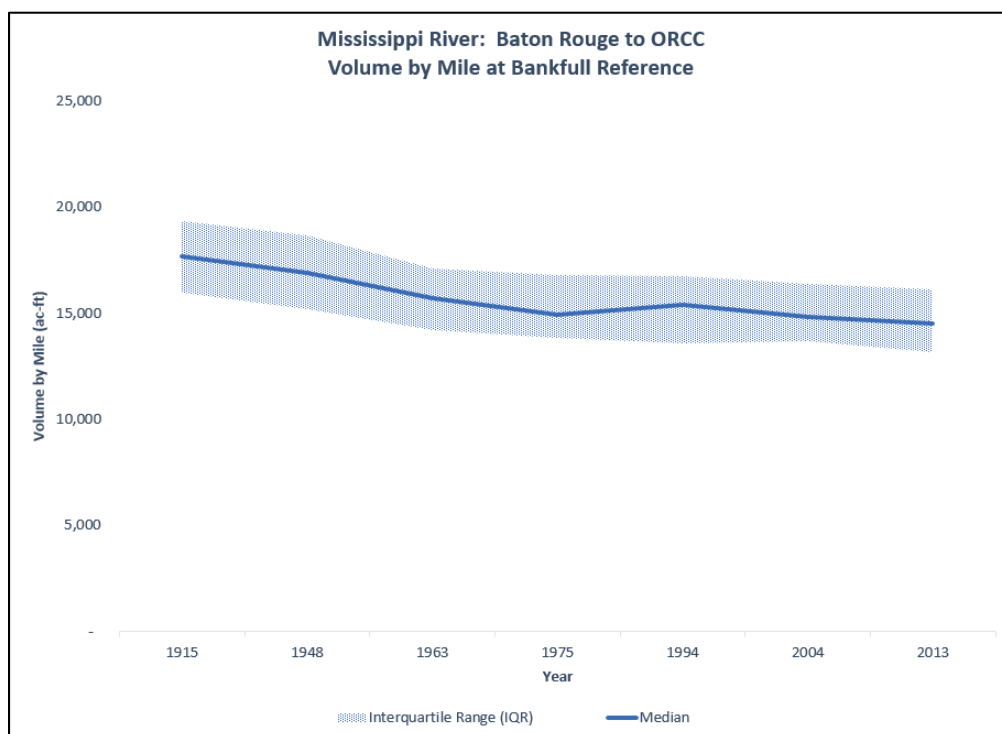


Figure 168. Mississippi River ORCC to Natchez, trend plot of channel volume at bankfull reference.

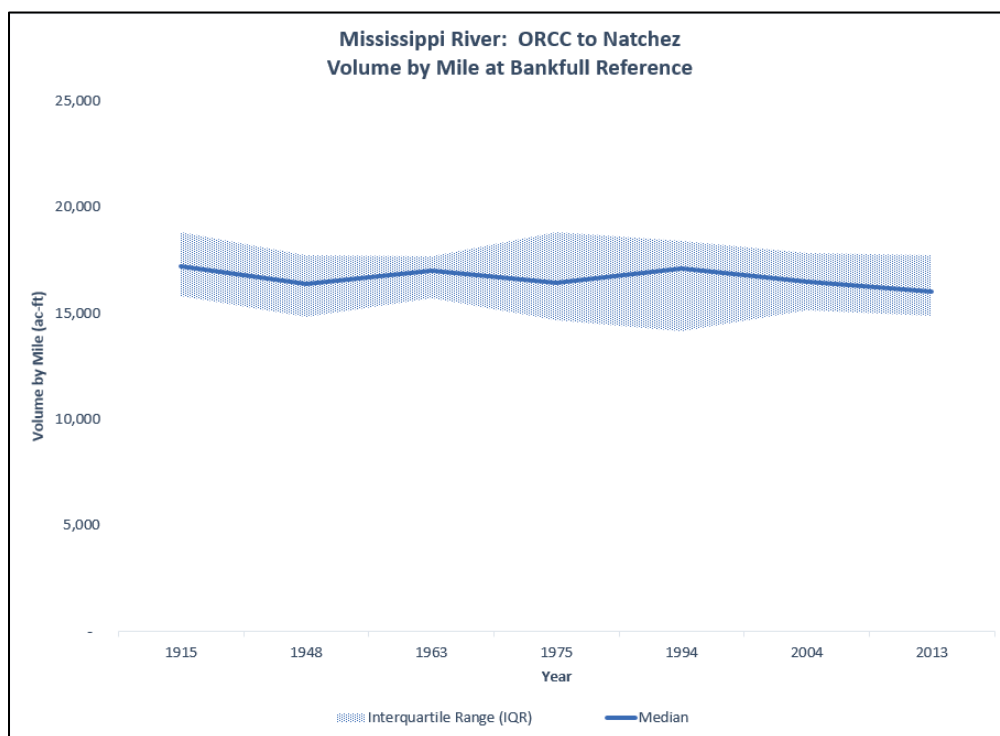
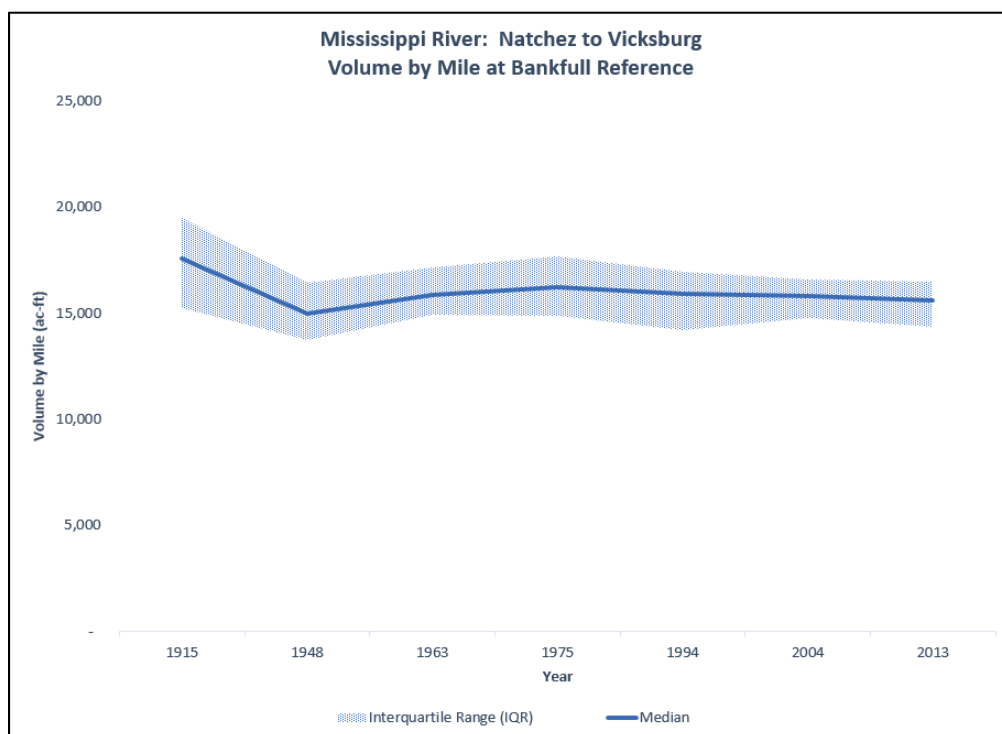


Figure 169. Mississippi River Natchez to Vicksburg, trend plot of channel; volume at bankfull reference.



3.4.2 Volumetric analysis–Atchafalaya River

The box-and-whisker plots of channel volume at low water reference for the Atchafalaya River geomorphic reaches are shown in Figures 170 through 172. For the Old River-to-WBPC geomorphic reach, Figure 170 indicates a slightly variable but generally stable trend in volume from 1976 to 2019, with a mild but consistent increasing trend (erosion) from 1998 to 2019. Figure 171 indicates a variable but generally consistent increase in median channel volume (erosion) from 1976 to 2019 for the WBPC-to-Grand Lake reach. Conversely, Figure 172 indicates a variable but generally decreasing trend (deposition) in median channel volume for the Grand Lake-to-Morgan City, LA, reach. Note that periodic maintenance dredging for navigation occurs in this reach, perhaps a reason for the broader IQR.

Figure 170. Atchafalaya River Old River to WBPC, channel volume at low water reference.

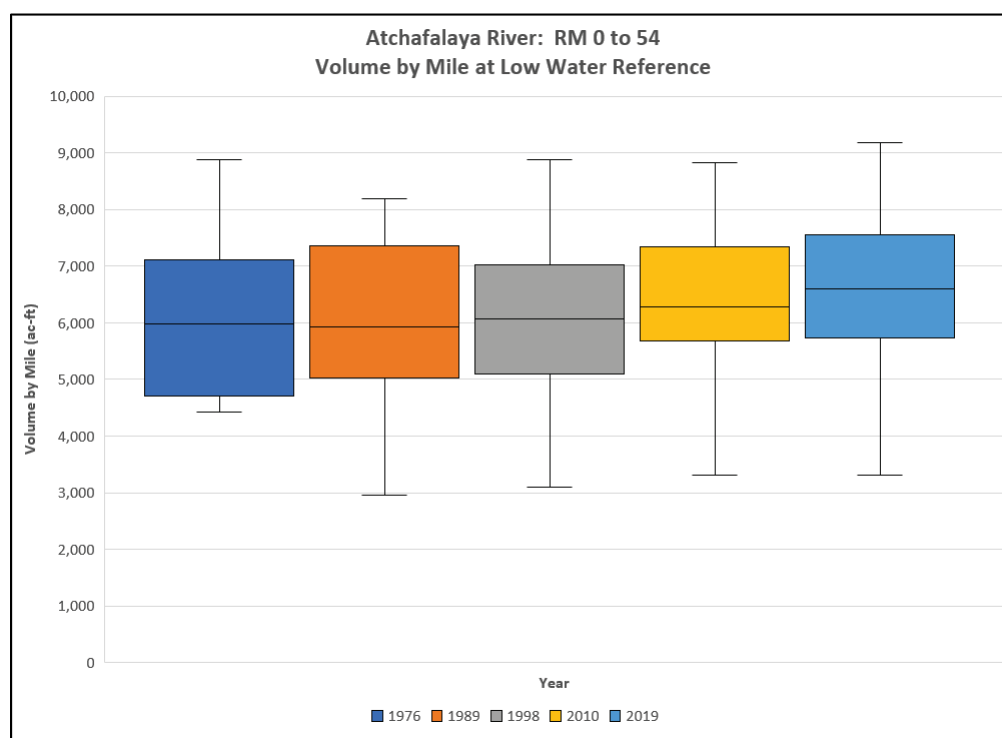


Figure 171. Atchafalaya River WBPC to Grand Lake, channel volume at low water reference.

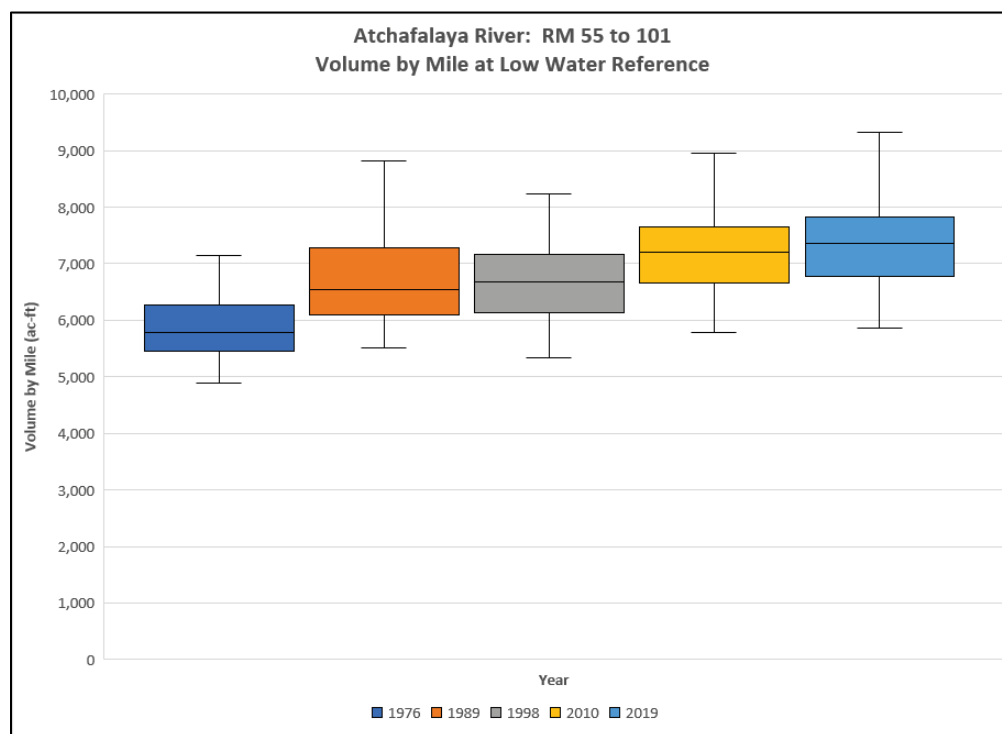
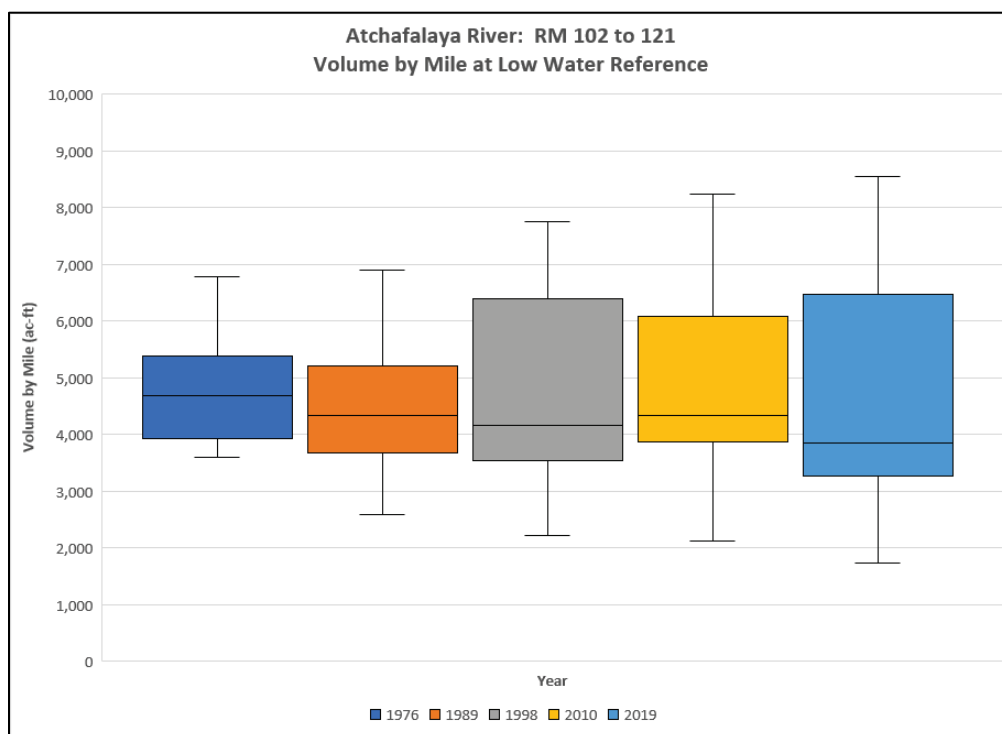


Figure 172. Atchafalaya River Grand Lake to Morgan City, LA, channel volume at low water reference.



The trend plots of channel volume at low water reference for the Atchafalaya River geomorphic reaches are shown in Figures 173 through 175. In general, the trends are similar to those indicated in the box-and-whisker plots. Of interest are the very slight trends in median channel volume indicated by the plots. Figure 173 indicates a very slight increasing trend (erosion) from 1998 to 2019 for the Old River to WBPC reach; however, the overall trend for the entire survey period of 1976 to 2019 is fairly stable. A consistent increasing trend in volume (erosion) is noted in Figure 174 for the WBPC to Grand Lake reach, possibly suggesting continued enlargement of the Whiskey Bay pilot channel. Figure 175 indicates a generally decreasing trend in volume (deposition) for the Grand Lake to Morgan City, Louisiana, with the exception of a slight increase in volume noted from 1998 to 2010.

Figure 173. Atchafalaya River Old River to WBPC, trend plot of channel volume at low water reference.

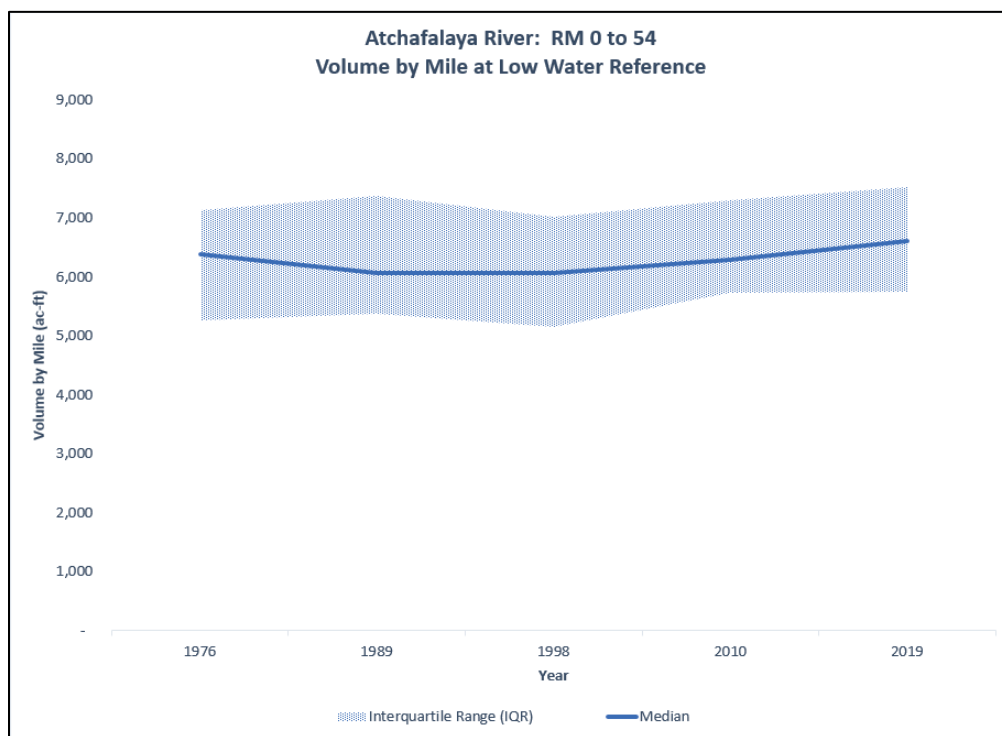


Figure 174. Atchafalaya River WBPC to Grand Lake, trend plot of channel volume at low water reference.

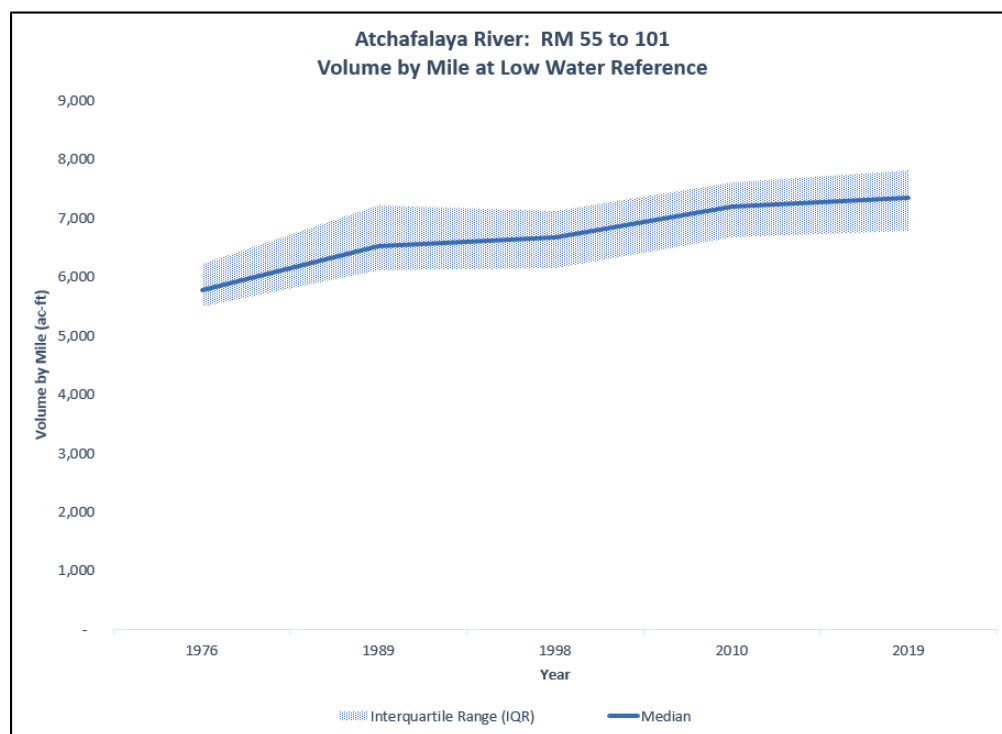
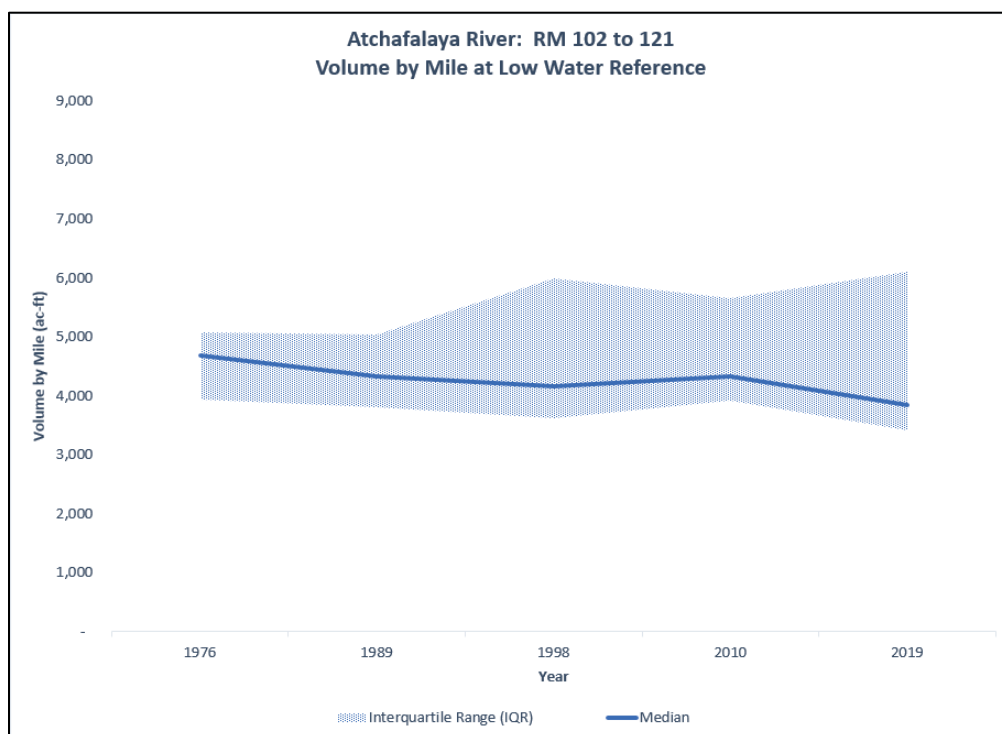


Figure 175. Atchafalaya River Grand Lake to Morgan City, LA, trend plot of channel volume at low water reference.



The box-and-whisker plots and trend plots of channel volume at bankfull reference for the Atchafalaya River geomorphic reaches are shown in Figures 176 through 178 and Figures 179 through 181, respectively. In general, the trends are similar to those indicated by the low water referenced data. The trends exemplified in Figures 176 and 179 for the Old River-to-WBPC reach show a decreasing trend in median volume (deposition) from 1976 to 1989, followed by a slight but consistent increasing trend (erosion) from 1989 to 2019. Overall, the trend is fairly stable over the entire time period. The trend plot shown in Figures 177 and 180 for the WBPC-to-Grand Lake reach shows a fairly consistent increasing trend in median volume (erosion) for the entire survey time period 1976 to 2010, with little change observed from 2010 to 2019. Figures 178 and 181 show a decreasing trend in median volume from 1976 to 1989 for the Grand Lake-to-Morgan City, LA, reach, followed by a fairly stable trend from 1989 to 2019.

Figure 176. Atchafalaya River Baton Old River to WBPC, channel volume at bankfull reference.

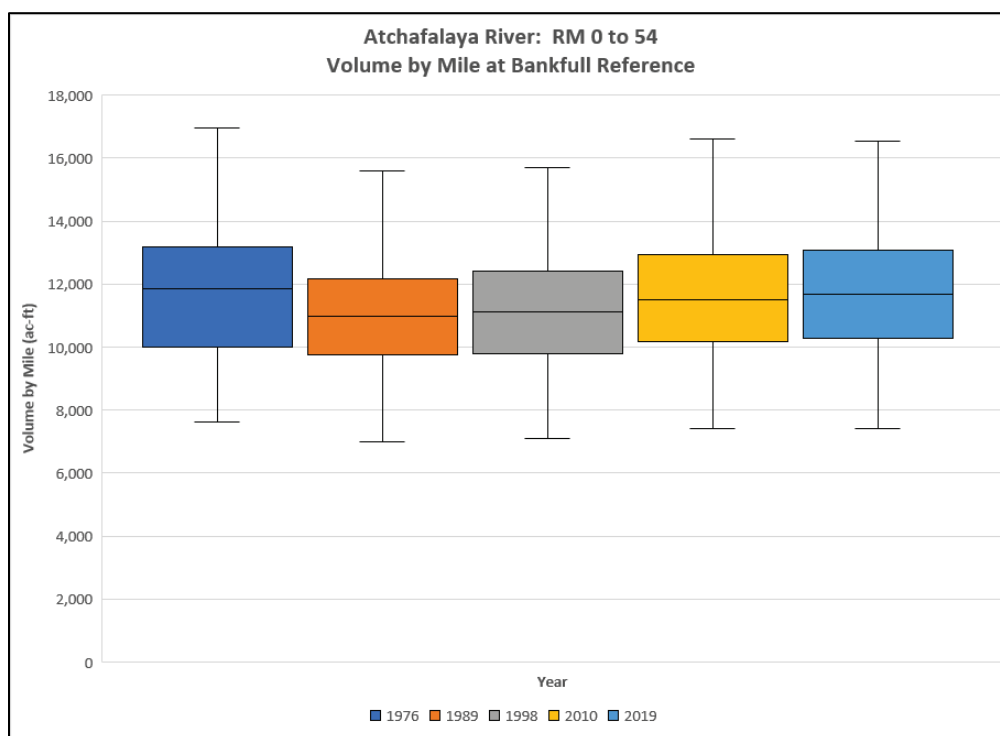


Figure 177. Atchafalaya River WBPC to Grand Lake, channel volume at bankfull reference.

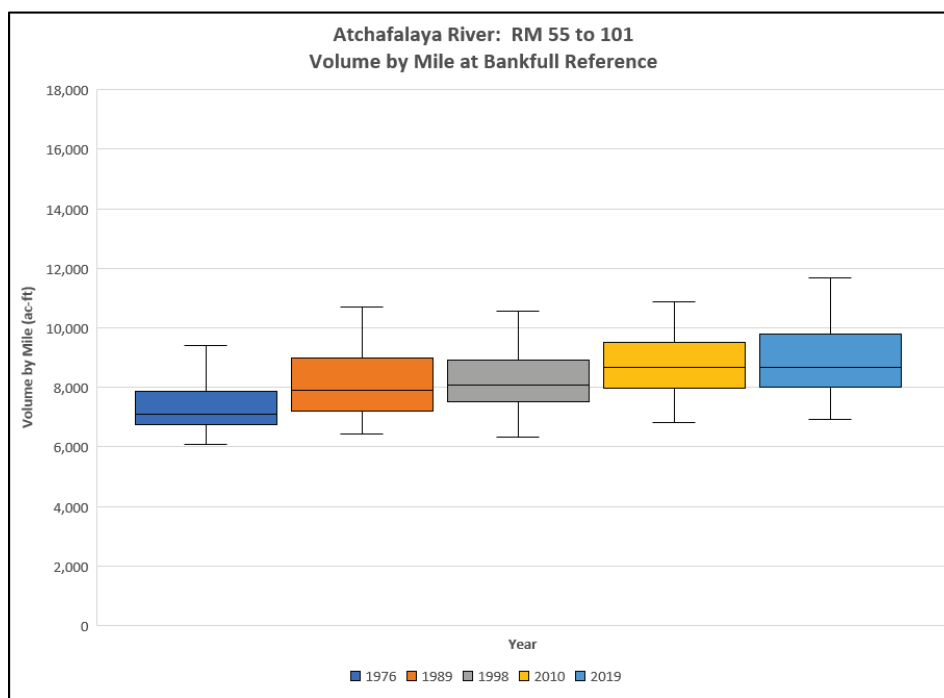


Figure 178. Atchafalaya River Grand Lake to Morgan City, LA, channel volume at bankfull reference.

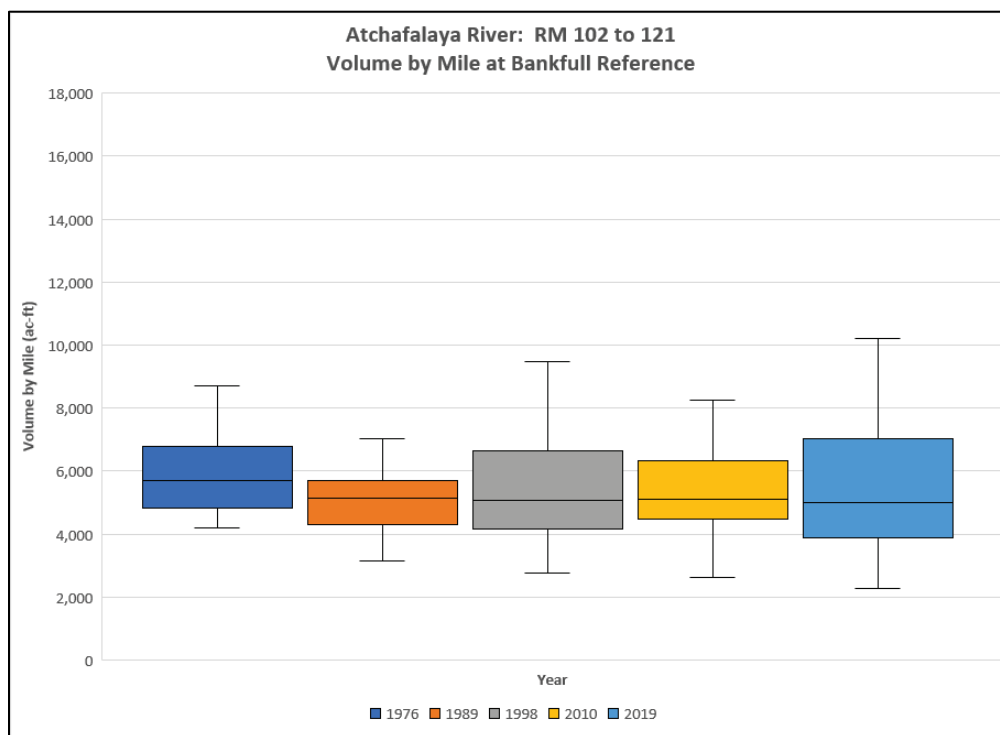


Figure 179. Atchafalaya River Old River to WBPC, trend plot of channel volume at bankfull reference.

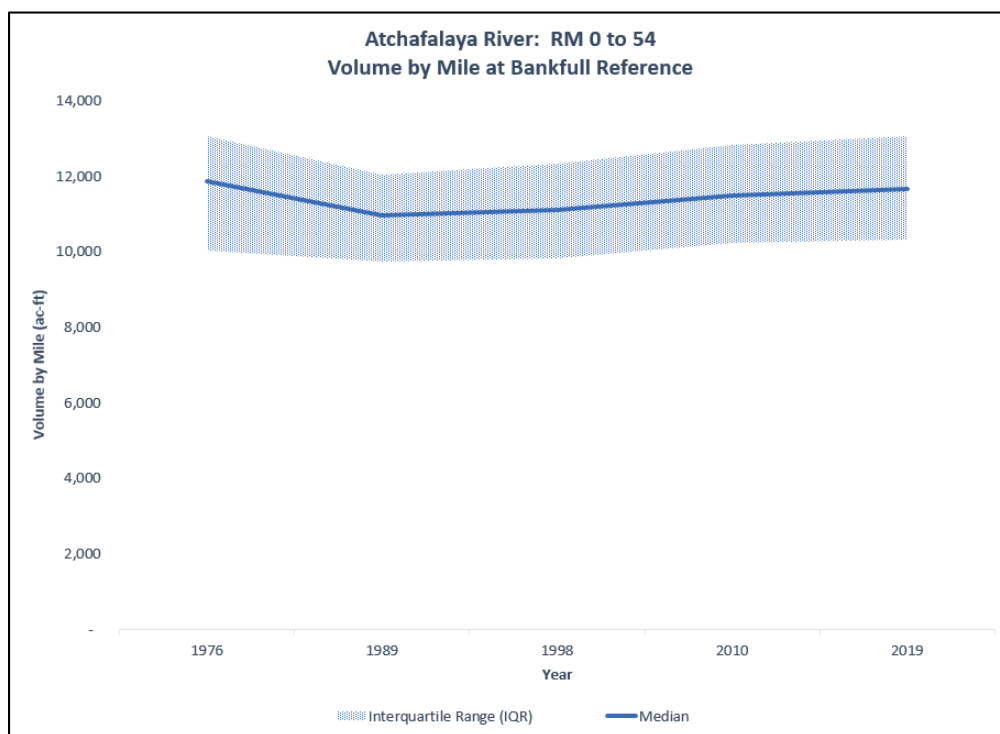


Figure 180. Atchafalaya River WBPC to Grand Lake, trend plot of channel volume at bankfull reference.

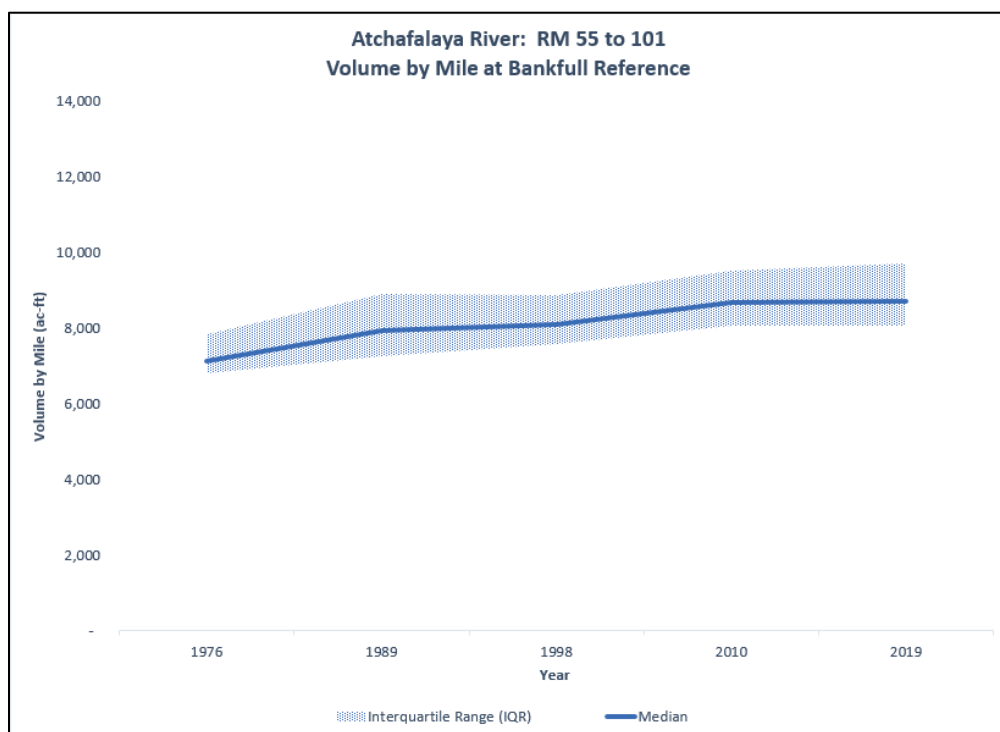
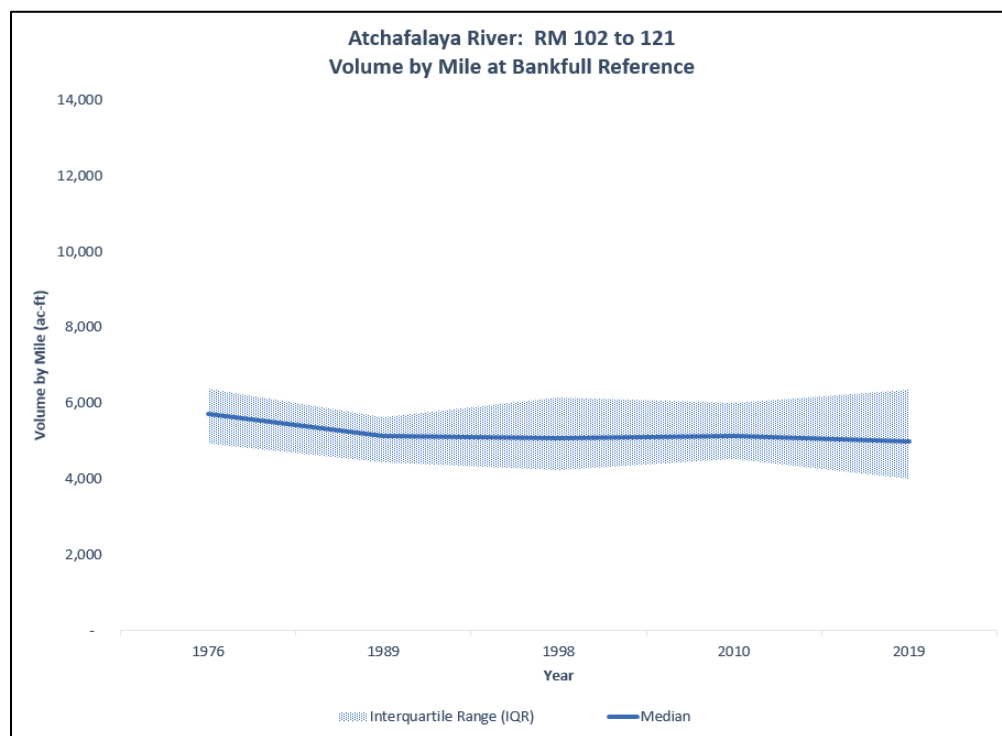


Figure 181. Atchafalaya River Grand Lake to Morgan City, LA, trend plot of channel; volume at bankfull reference.



3.4.3 Volumetric analysis–Old River

The volumetric analysis for the Old River channels varies slightly from the previous analyses, as the volumes are computed for the entire channel segment rather than for 1 mi segments, due to the short reach lengths. As such, there is no statistical evaluation with the box-and-whisker plots, but trends are determined from the plots of the total reach volume by survey time period. The results are presented for the outflow channel in its entirety from the low sill structure to the Red River and for the inflow and outflow channels of the auxiliary structure and the hydropower plant.

Note that the outflow channel segments, beginning at the low sill structure and progressing downstream, vary in the hydraulic regime to which they have been exposed. The channel segment from the low sill structure to the auxiliary outflow channel has only experienced flows and sediment passing through the low sill structure for its entire history. The channel segment between the auxiliary outflow channel and the hydropower plant outflow channel has experienced flows and sediment from the low sill structure only from 1963 to 1986, when the auxiliary structure was placed

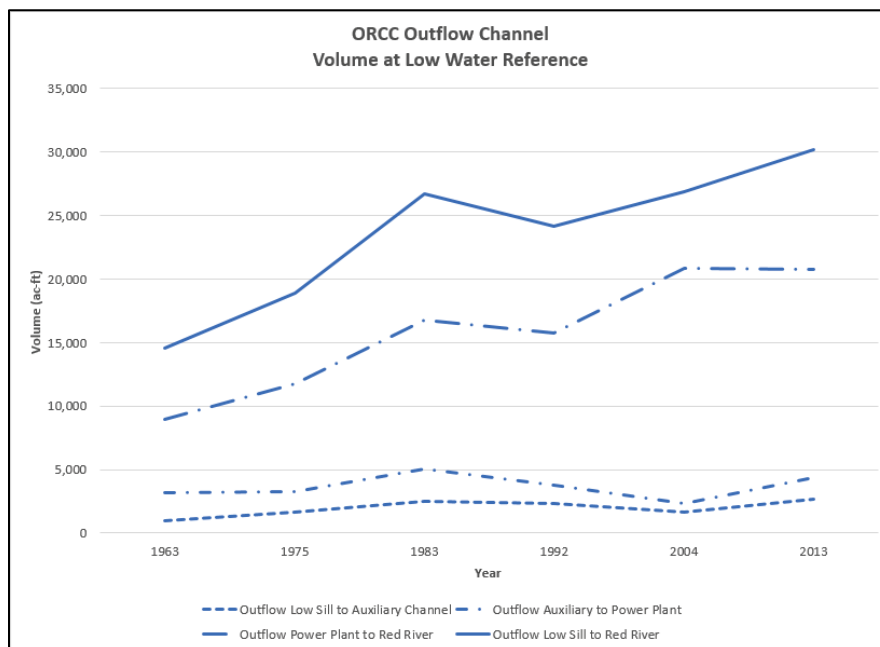
in operation, and from both structures from 1986 to 2013. Differences in the sediment passing characteristics of the individual structures have likely altered the inflowing sediment load to this segment, based on which structure has been used the most during a given time period. The channel segment from the hydropower plant to the Red River has been exposed to flows and sediment from the low sill structure only from 1963 to 1986, from the low sill and auxiliary structures from 1986 to 1990, when the hydropower plant began operation, and from all three facilities from 1990 to 2013. Additionally, the entire outflow channel downstream of the low sill structure has received flows and sediment from the overbank structure during infrequent periods of operation during major flood events.

The computed channel volume at low water reference for the ORCC outflow channel below the low sill structure is shown in Figure 182. The volume of the channel segment from the low sill structure to the auxiliary structure outflow channel has varied over the survey time periods, with slight increase in volume (erosion) from 1963 to 1983, little change from 1983 to 1992, decrease in volume (deposition) from 1992 to 2004, and increase in volume (erosion) from 2004 to 2013. The channel segment from the auxiliary structure outflow channel to the hydropower plant outflow channel exhibits similar trends as the previous segment.

The outflow channel segment from the hydropower plant outflow channel to the Red River has exhibited the most notable adjustment in channel volume. This channel segment showed a significant trend in increased volume (erosion) from 1963 to 1983, nearly doubling in volume over this period. From 1983 to 1992, the channel segment experienced a slight reduction in volume (deposition), followed by an increase in volume of approximately 25% from 1992 to 2004. There was generally no change from 2004 to 2013.

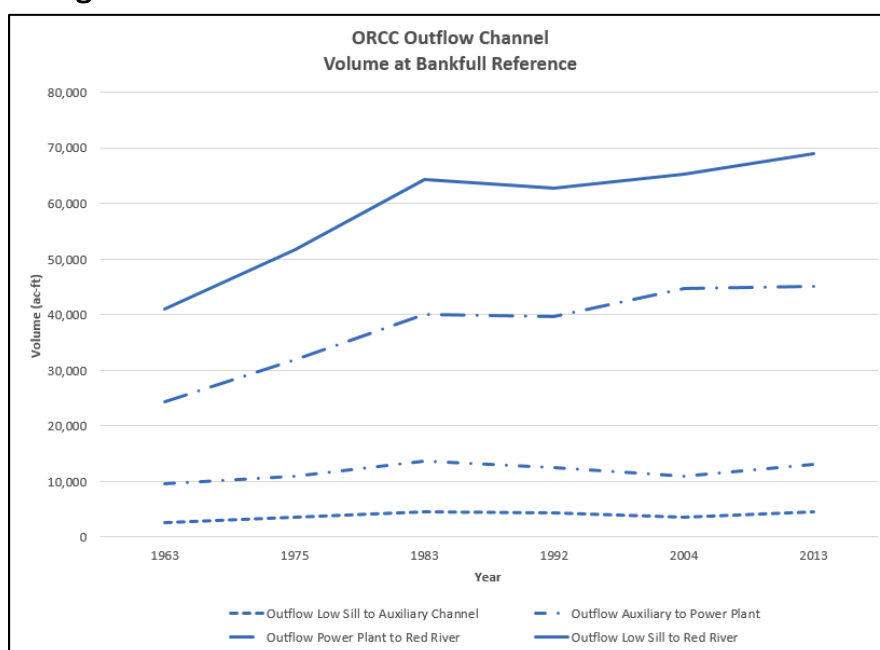
The plot of the entire outflow channel from the low sill structure to the Red River indicates the channel volume has increased (erosion) for the entire survey time period, with the exception of 1983 to 1992. The outflow channel volume has approximately doubled from 1963 to 2013.

Figure 182. ORCC outflow channel volume at low water reference.



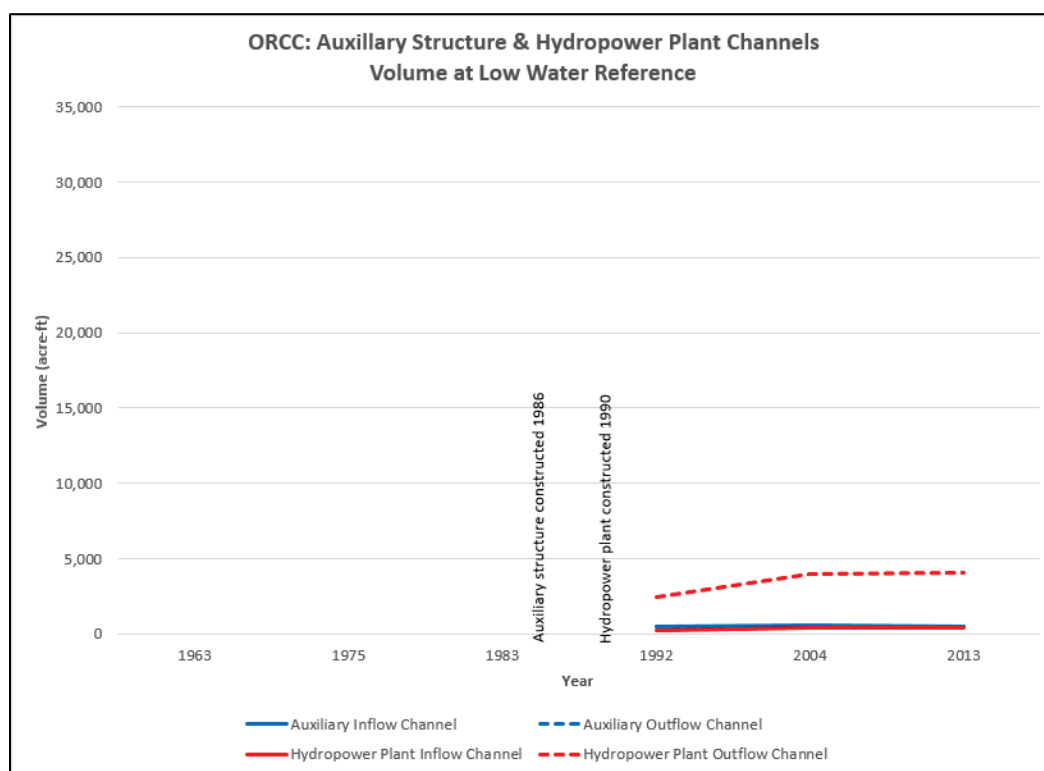
The computed channel volume for the ORCC outflow channel referenced to bankfull conditions is presented in Figure 183. In general, the trends in volume are very similar to those observed for the low water referenced data. In comparison to the low water referenced data, the increase in channel volume for the entire outflow channel is only 75% for the period 1963 to 2013.

Figure 183. ORCC outflow channel volume at bankfull reference.



The plots of channel volume for the auxiliary structure and hydropower plant channels are shown in Figure 184. With the exception of the hydropower plant outflow channel, the channel volumes have been fairly consistent over the survey time periods. The outflow channel of the hydropower plant experienced significant increase in volume (erosion) from 1992 to 2004, followed by little to no change from 2004 to 2013. The plot for the hydropower plant inflow channel indicates an increasing trend in volume from 1992 to 2004, then stabilizes from 2004 to 2013. Both the inflow and outflow channels of the auxiliary structure have been fairly consistent in volume over the survey time periods. Note that previous studies (Heath et al. 2015) report the auxiliary structure inflow channel acts as a sediment trap, requiring periodic flushing operations.

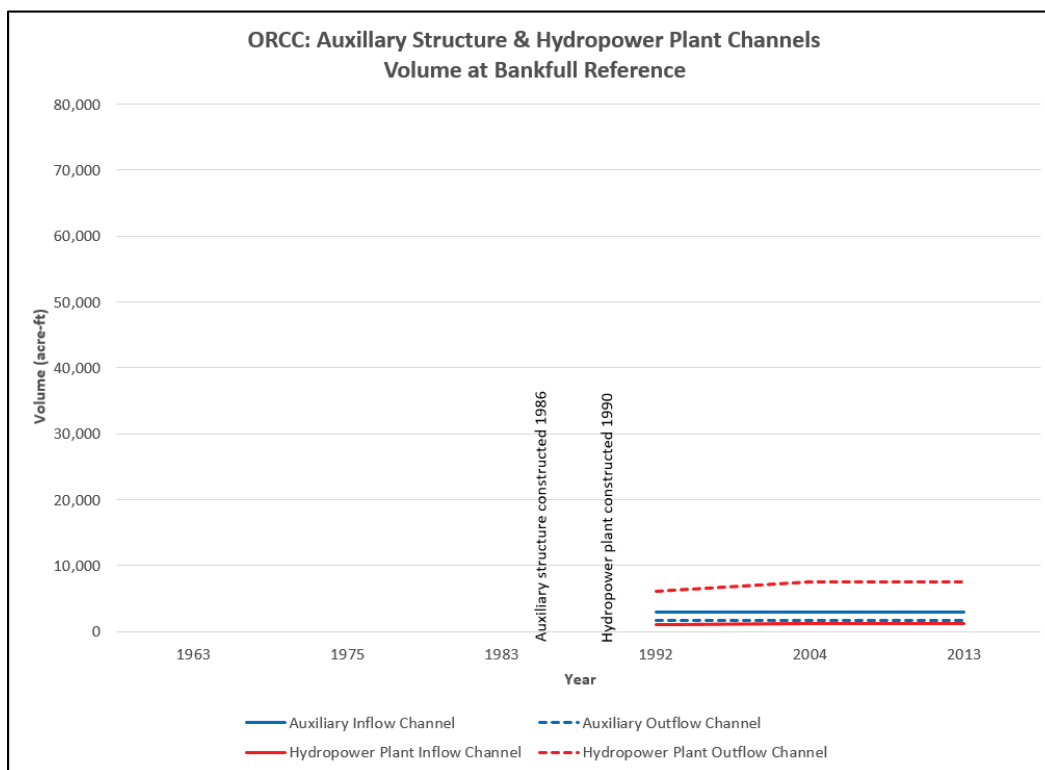
Figure 184. ORCC auxiliary structure and hydropower plant channel volume at low water reference.



The computed channel volume for the ORCC auxiliary structure and hydropower plant channels referenced to bankfull conditions is shown in Figure 185. The trends in volume are very similar to those observed for low water referenced data. Very little adjustment is noted in the channels, with the exception of the hydropower plant outflow channel. As was the case with the low water referenced data, the hydropower plant outflow channel

volume increased significantly (erosion) from 1992 to 2004, then stabilized from 2004 to 2013.

Figure 185. ORCC auxiliary structure and hydropower plant channel volume at bankfull reference.



4 Comparison with 1951 MRC Atchafalaya River Study

A study of the Atchafalaya River was conducted by USACE for the MRC that focused on engineering and geological investigations of the enlargement of Old River and the Atchafalaya River. The study report (USACE 1951) documented the rate and extent of progressive changes in the geometry of the rivers and concluded that these changes indicated the probable capture of the Mississippi River by the Atchafalaya River. This study and report were the catalyst for the planning, design, and construction of the ORCC low sill structure and overbank structure.

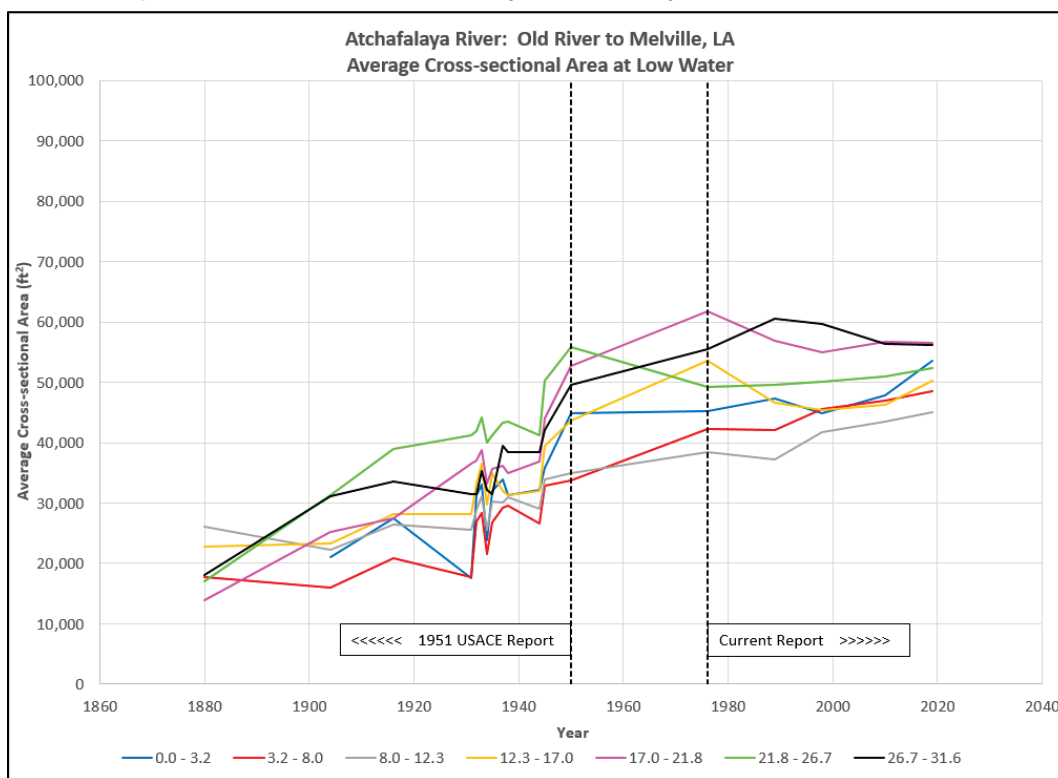
The analysis methodologies used in the 1951 study were very similar to those used in the assessment reported herein. Geometric parameters of cross-sectional area, width, and depth were computed relative to low water and bankfull references for transects along the river and were grouped by reach to determine the average value. The reaches in the 1951 study were generally much shorter than those in this report, ranging approximately 3 to 5 mi in length. The survey data used in the 1951 study range in time from 1880 to 1950, with the majority of data collected in the 1930s.

The results of the current assessment were compared to the 1951 study results by essentially appending the current assessment results for cross-sectional area, width, and depth to the 1951 tables and extending the data set to 2019. The current assessment geometric parameters were grouped according to the same reach extents as the 1951 study for determination of average values, and the average values for each reach were plotted by time. The current assessment values were computed referenced to the same low water and bankfull elevations as stated in the 1951 data tables in Volume 3 of the 1951 report; there was no reprocessing of the historic data. Note that no attempt to correct current assessment data for the historical datums of the 1951 data were attempted. This is expected to introduce some uncertainty into the comparison of assessment results; however, given the likely inaccuracies of the historical survey data by nature, any such uncertainty due to datum discrepancies (<0.4 ft) should not preclude the usefulness of a comparison of study results.

4.1 Comparison of average cross-sectional area

The comparison of the 1951 study and current assessment average cross-sectional area referenced to low water is shown in Figure 186 for the Old River-to-Melville, LA, reach, and in Figure 187 for the Melville-to-the head of WBPC. The division of the average reach data into two plots was done for clarity and does not reflect a reach delineation in the 1951 report. Each curve of the plot represents the average value for a reach defined by the river mile extents indicated by the curve labels in the plot legend.

Figure 186. Atchafalaya River average cross-sectional area at low water reference as compared to 1951 MRC Atchafalaya River study, Old River to Melville, LA.



The results of the 1951 study indicate the average cross-sectional area for the reaches from Old River to Melville (Figure 186) has generally increased since 1880, with an accelerated rate observed through the mid-1930s to the mid-1940s. With the exception of a couple of reaches, the average area continued to generally increase from 1950 to 1976. For the survey time periods of the current assessment, 1976 to 2019, the average cross-sectional area has been variable, with some reaches increasing and some reaches decreasing in average area. Note that there are no observed data between 1950 and 1976, and the curves are assumed as linear during the period.

Figure 187. Atchafalaya River average cross-sectional area at low water reference as compared to 1951 MRC Atchafalaya River study, Melville, LA, to WBPC.

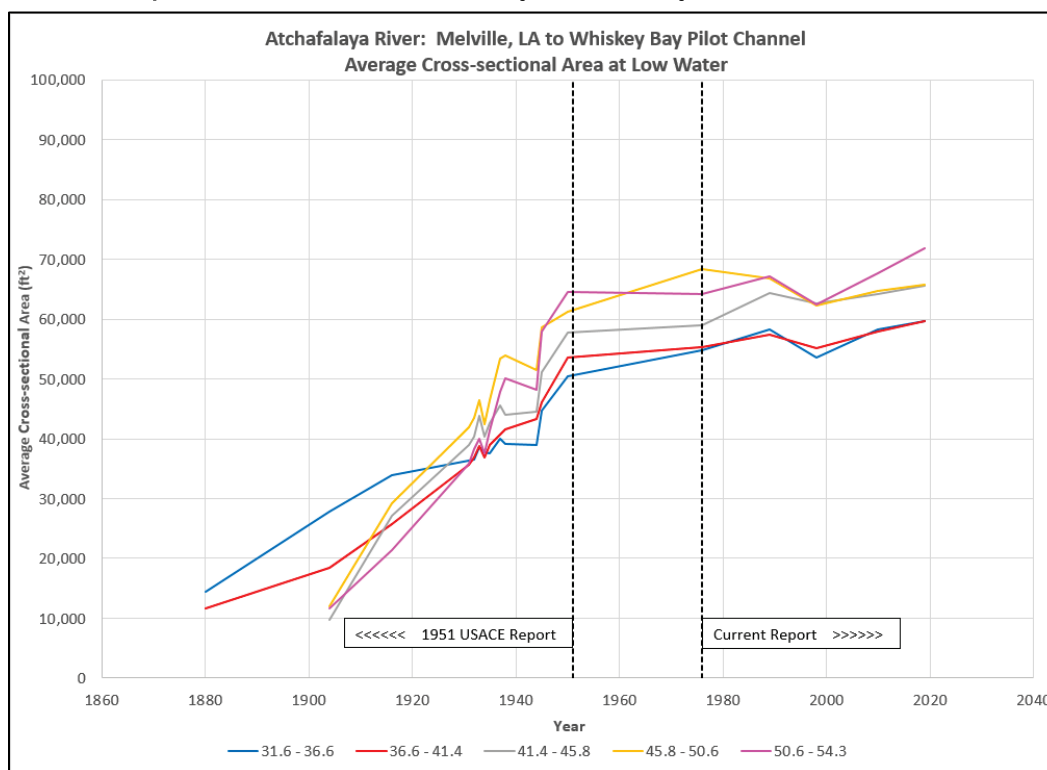


Figure 187 shows the average cross-sectional area for the reaches from Melville to the head of WBPC has generally increased from 1880 to 1950. The plot indicates the average area from the 1951 report to the current report is still increasing but at a much lesser rate.

Comparatively, the average area during the current assessment period is variable but generally continues along the same trend as from 1951 to the beginning of the current assessment period.

The comparison of the 1951 study and current assessment average cross-sectional area referenced to bankfull is shown in Figure 188 for the Old River-to-Melville, LA, reach, and in Figure 189 for the Melville-to-the head of WBPC reach.

Figure 188. Atchafalaya River average cross-sectional area at bankfull reference as compared to 1951 MRC Atchafalaya River study, Old River to Melville, LA.

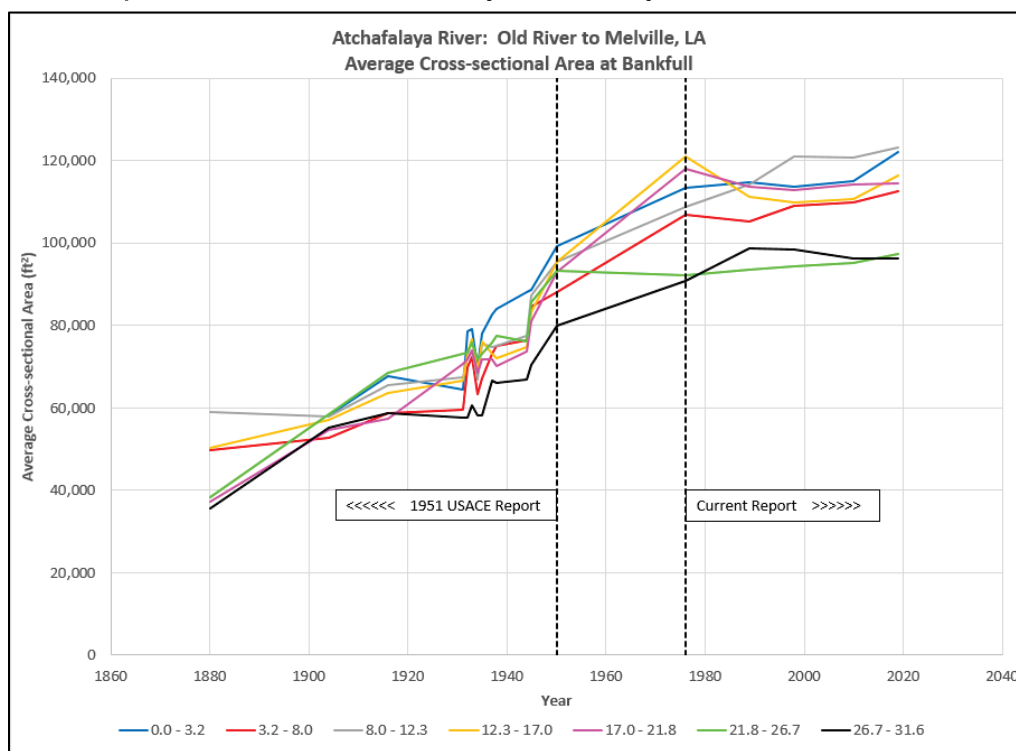
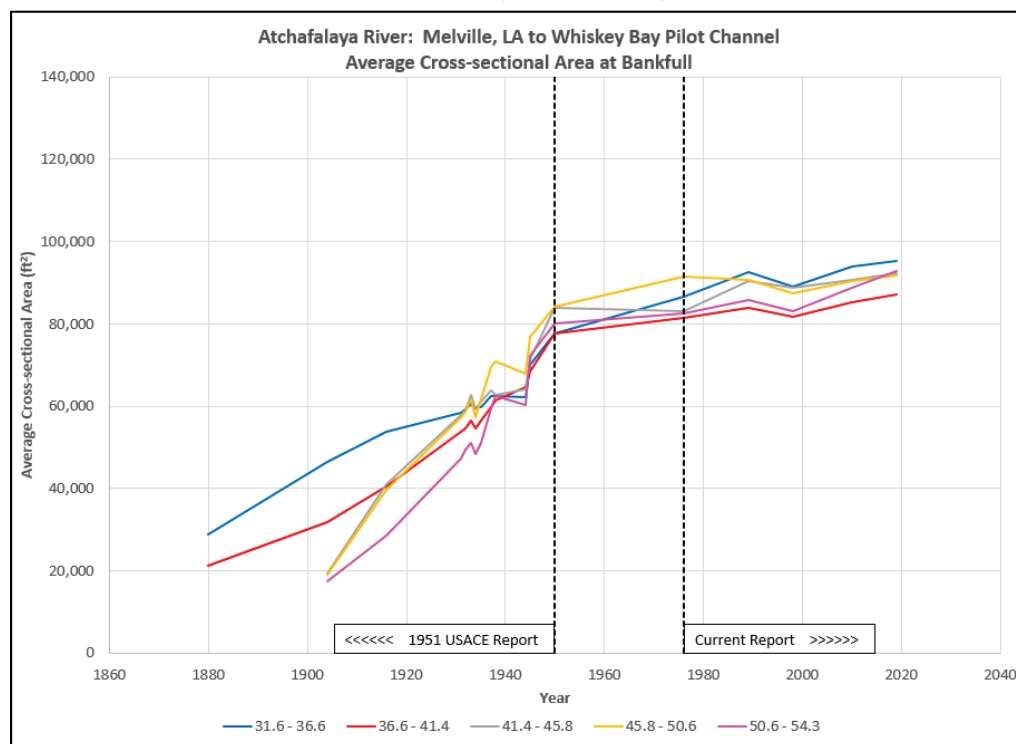


Figure 189. Atchafalaya River average cross-sectional area at bankfull reference as compared to 1951 MRC Atchafalaya River study, Melville, LA, to WBPC.



The results of the 1951 study indicate the average cross-sectional area for the reaches from Old River to Melville (Figure 185) has generally increased since 1880, with an accelerated rate observed through the mid-1930s to the mid-1940s. With the exception of one reach, the average area continued to increase from 1950 to 1976. For the survey time periods of the current assessment, 1976 to 2019, the average cross-sectional area has been variable but generally consistent for the period. Figure 189 shows the average cross-sectional area for the reaches from Melville to the head of WBPC has generally increased from 1880 to 1950. The plot indicates the average area from the 1951 report to the current report is still increasing, but at a much lesser rate.

Comparatively, the average area during the current assessment period is variable but generally continues along the same trend as from 1951 to the beginning of the current assessment period. Also, note that the average area to which the reaches have ultimately developed is 25% to 30% less than the area for the reaches from Old River to Melville.

4.2 Comparison of average width

The comparison of the 1951 study and current assessment average channel width referenced to low water is shown in Figure 190 for the Old River-to-Melville, LA, reach, and in Figure 191 for the Melville-to-the head of WBPC. The average width for the Old River to Melville reaches shown in Figure 190 is variable from 1880 to the mid-1910s, with a definitive increase in width from then until the time of the 1951 report. The width continues to increase during the time from the 1951 report to the beginning of the current assessment period but shows a trend of slight increase to little change for the current assessment period. Figure 191 indicates the average width for the reaches from Melville to the head of WBPC follow trends of increasing width for the entire time period encompassed by the 1951 report and the current assessment, although the rates of increase are generally less for the post 1951 report period.

Figure 190. Atchafalaya River average channel width at low water reference as compared to 1951 MRC Atchafalaya River study, Old River to Melville, LA.

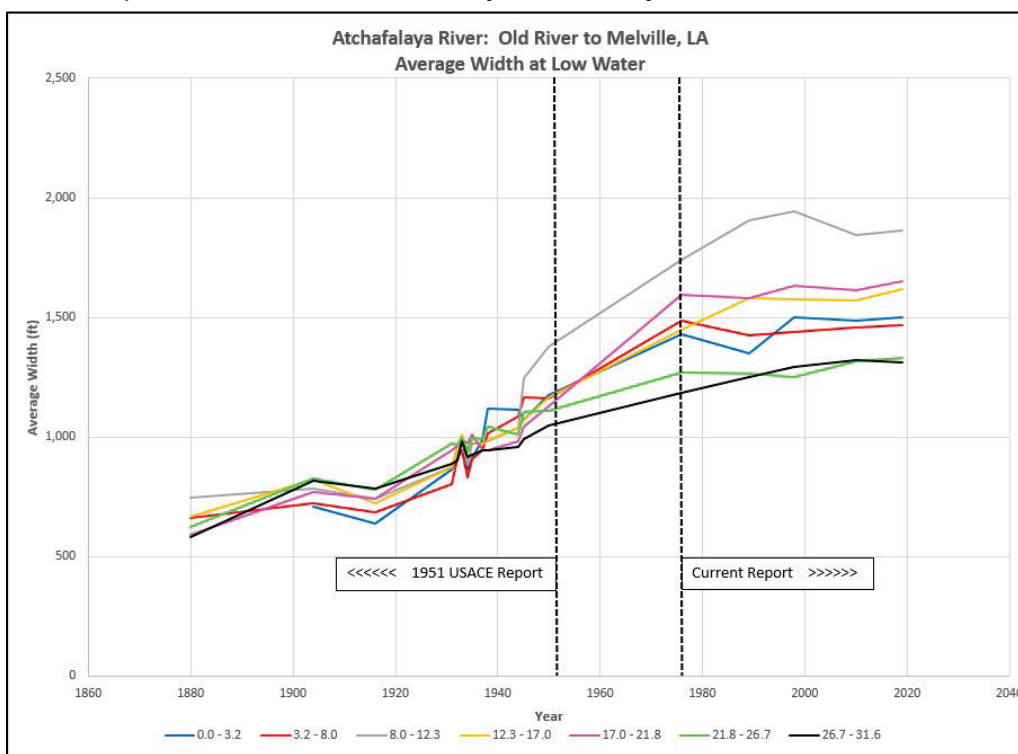
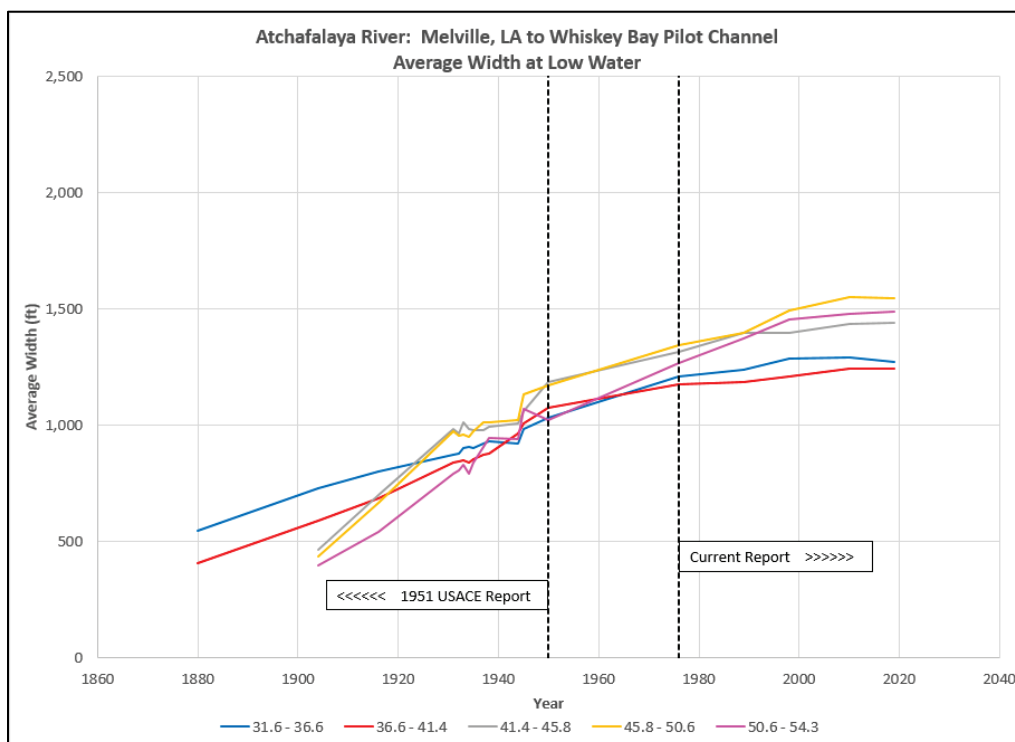


Figure 191. Atchafalaya River average channel width at low water reference as compared to 1951 MRC Atchafalaya River study, Melville, LA, to WBPC.



The comparison of the 1951 study and current assessment average channel width referenced to bankfull is shown in Figure 192 for the Old River to Melville, LA, reach, and in Figure 193 for the Melville to the head of WBPC. In general, the trends are similar to those observed for the channel width referenced to low water. The average width for the reaches for both the Old River to Melville and Melville to WBPC indicate increasing trends throughout the entire time period encompassed by the 1951 report and the current assessment, with the rates of increase generally less to little change for the current assessment time period.

Figure 192. Atchafalaya River average channel width at bankfull reference as compared to 1951 MRC Atchafalaya River study, Old River to Melville, LA.

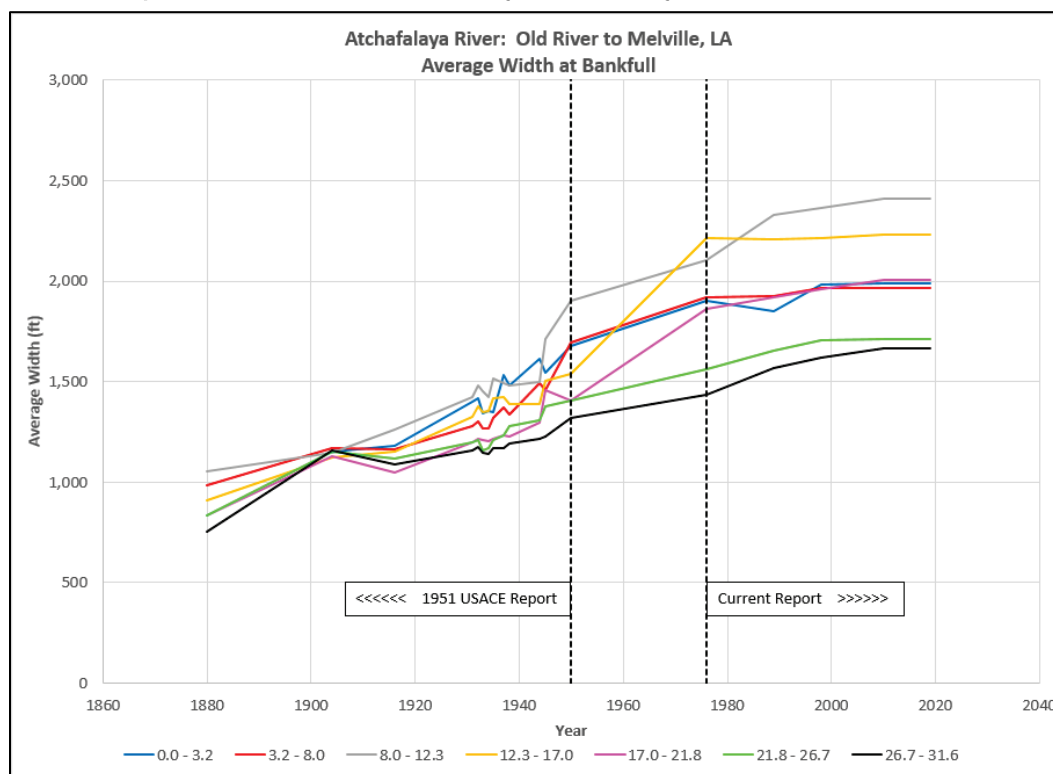
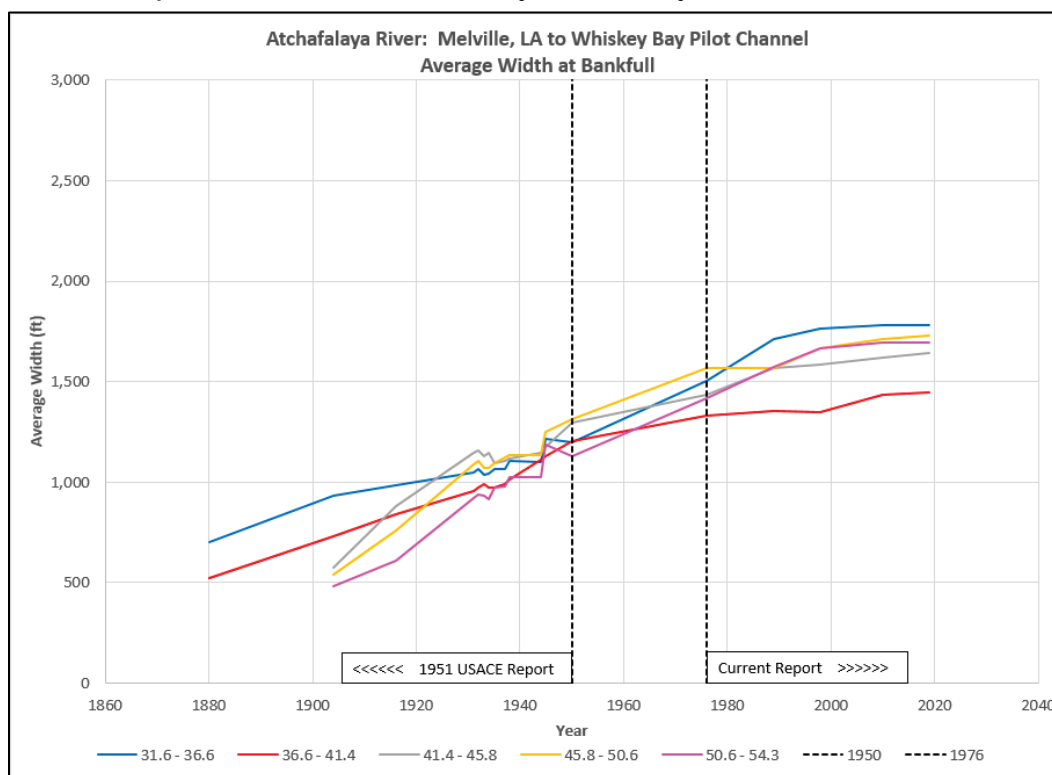


Figure 193. Atchafalaya River average channel width at bankfull reference as compared to 1951 MRC Atchafalaya River study, Melville, LA, to WBPC.



4.3 Comparison of average depth

The comparison of the 1951 study and current assessment average depth referenced to low water is shown in Figure 194 for the Old River to Melville, LA, reach, and in Figure 195 for the Melville-to-the head of WBPC. Figure 194 shows that the average depth for the reaches from Old River to Melville are highly variable over the entire time period of both the 1951 report and the current assessment, with many reaches indicating little overall change for the period. For the reaches from Melville to the head of WBPC, the average depth showed a general trend of increasing average depth for the time period covered by the 1951 report. From the 1951 report through the current assessment period, the average depth has followed a trend of slightly decreasing depth to little change.

Figure 194. Atchafalaya River average depth at low water reference as compared to 1951MRC Atchafalaya River study, Old River to Melville, LA.

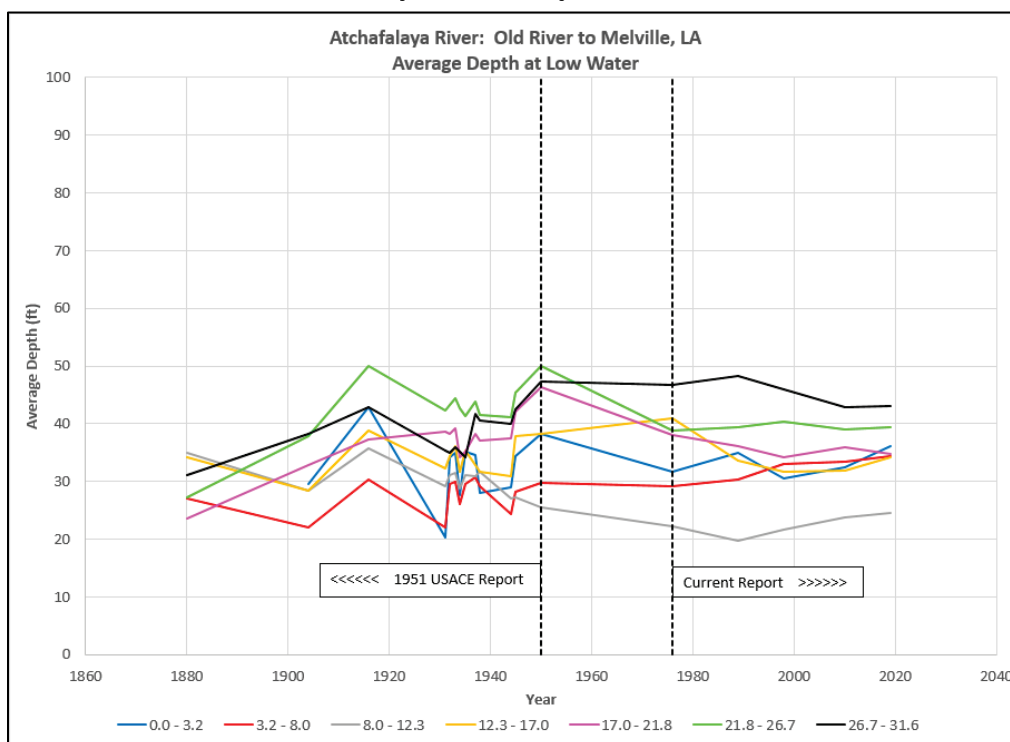
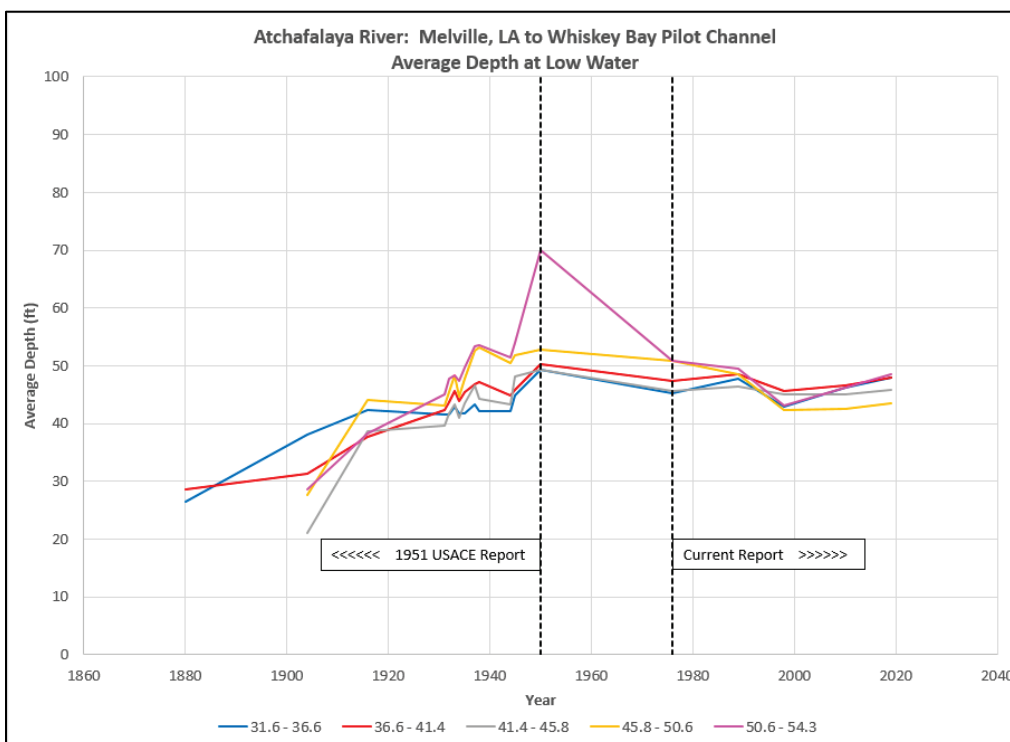


Figure 195. Atchafalaya River average depth at low water reference as compared to 1951MRC Atchafalaya River study, Melville, LA, to WBPC.



The comparison of the 1951 study and current assessment average depth referenced to bankfull is shown in Figure 196 for the Old River to Melville, LA, reach, and in Figure 197 for the Melville-to-the head of WBPC. The trends in average depth are very similar to those observed for the low water referenced data. Figure 196 shows the average depth for the reaches from Old River to Melville to fluctuate slightly over the entire time period of the 1951 report and the current assessment, with the overall trend in depth being generally consistent. A slight increase in depth is observed from 1880 to the 1951 report, and a slight decrease in depth is noted from the 1951 report through the current assessment time period for most reaches. Figure 197 shows an increase in depths at bankfull for the reaches from Melville to the head of WBPC for the 1951 report time period, and a slight decrease to little change in depth from the time of the 1951 report through the current assessment time period.

Figure 196. Atchafalaya River average depth at bankfull reference as compared to 1951 MRCatchafalaya River study, Old River to Melville, LA.

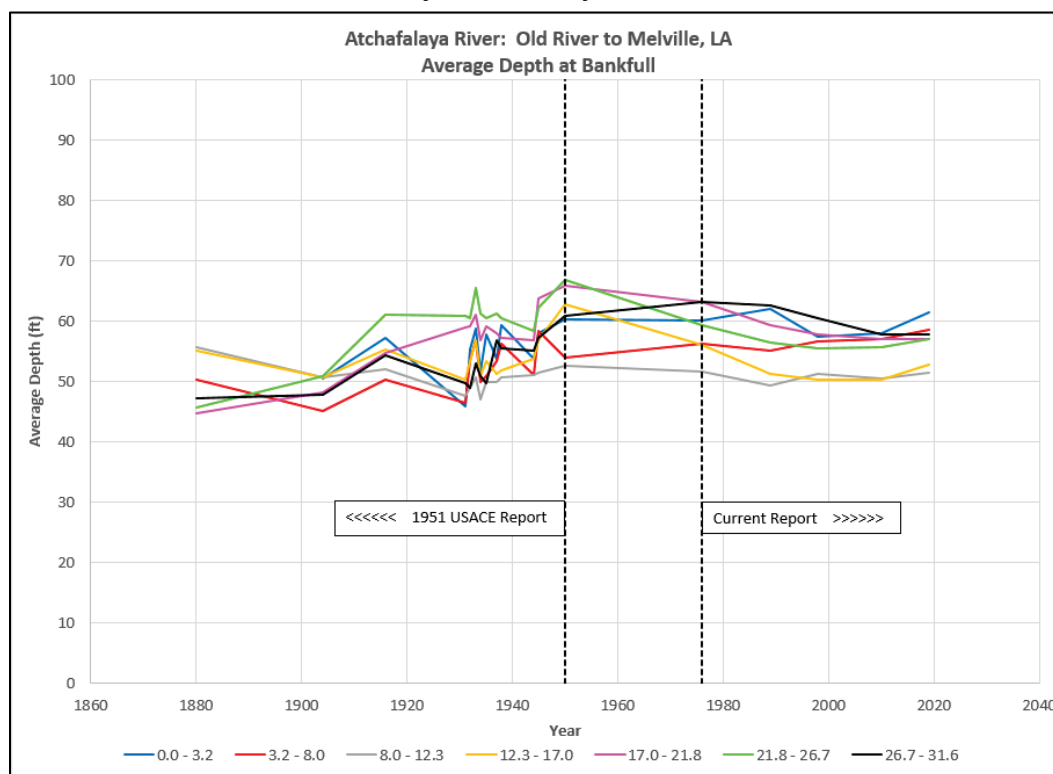
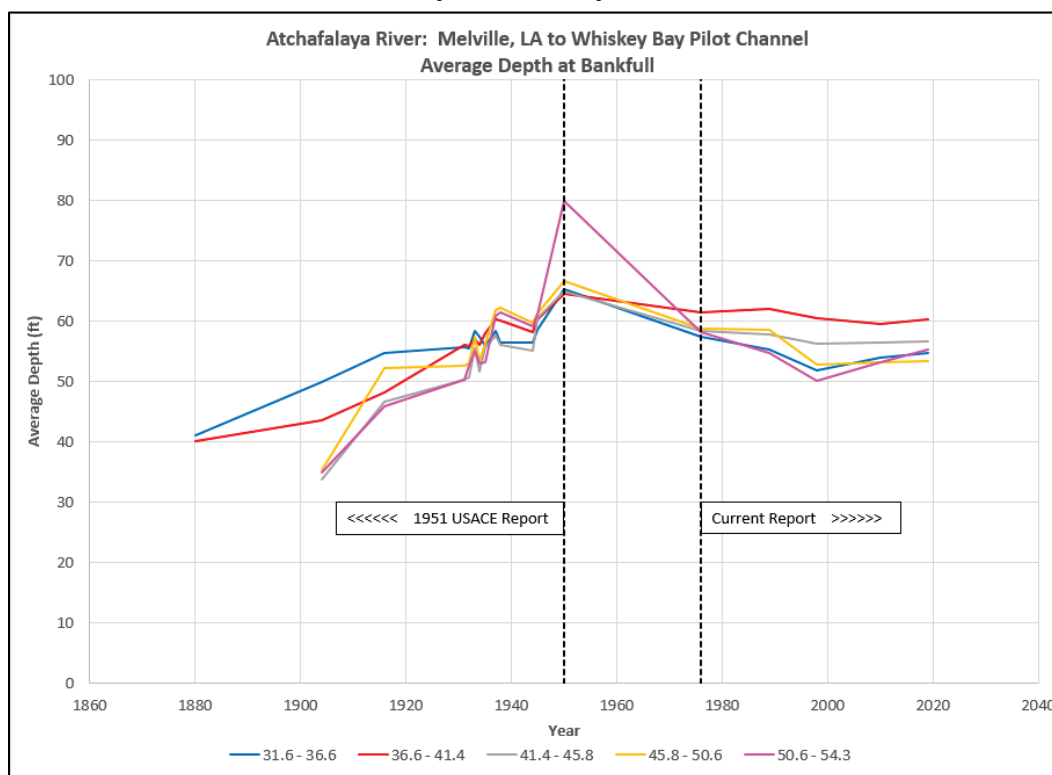


Figure 197. Atchafalaya River average depth at bankfull reference as compared to 1951 MRCatchafalaya River study, Melville, LA, to WBPC.



The results of the cross section geometric parameter analysis and the volumetric data analysis were integrated to form an assessment of long-term morphological trends for the reaches of the rivers of the OMAR assessment area. This assessment is based solely on the results of the geometry analysis and should not be viewed as a complete geomorphic assessment for the reaches. However, these assessments can be integrated with results from the other geomorphic assessment tasks that are being conducted as part of the OMAR Assessment to formulate a more comprehensive assessment of the long-term trends within the rivers. The reach assessments will be based on the reach limits described in Table 2.

The morphology of each geomorphic reach was based on a qualitative evaluation of whether each reach is erosional, depositional, in a state of dynamic equilibrium, or in a transition between two states, and the time periods over which the trends were occurring. As such, these assessments are somewhat subjective in nature. However, these trends are useful to inform other quantitative analyses such as numerical models, in addition to providing valuable insight into the long-term historical trends of channel adjustment within the OMAR Assessment area.

4.4 Mississippi River geomorphic reaches

4.4.1 Baton Rouge to ORCC low sill structure inlet (RM 230–314)

The predominant morphological trends for this reach are depositional from 1915 to approximately 1975 or 1988, then less depositional to dynamic equilibrium to 2013. Reduction in median values of cross-sectional area, hydraulic depth, and channel volume from 1915 to 1975/1988 indicate general deposition during this period. Although values fluctuate, the median values of these parameters are generally stable to slightly decreasing, indicating a channel near dynamic equilibrium but still slightly depositional. Median channel width is generally stable for the entire time period, with the exception of the drought year 1988, indicating the channel adjustments are generally being accomplished through channel incision/aggradation (Table 4).

4.4.2 ORCC low sill structure inlet to Natchez, Mississippi (RM 314–363)

The morphological trends for this reach typically display more variability in the geometric parameters and channel volume over the time period. Median values of cross-sectional area, hydraulic depth, and channel volume from 1915 to 1963 generally indicate slight deposition to dynamic equilibrium during this period. The reach appears slightly erosional to dynamic equilibrium from 1963 to 1988, and slightly depositional to dynamic equilibrium from 1988 to 2013. Median channel widths show little change during the time period, indicating the predominant means of channel adjustment is channel incision/aggradation (Table 4).

4.4.3 Natchez, MS, to Vicksburg, MS (RM 363–435)

The morphological trends for this reach display some variability in the geometric parameters and channel volume over the time period but are generally stable over the period. The period 1915 to 1948 is characterized by deposition, the period 1948 to 1975 by slight erosion to dynamic equilibrium, and 1975 to 2013 by slight deposition. The channel width, although variable, follows an increasing trend from 1915 to 1988 and a decreasing to constant trend from there to 2013 (Table 4).

The general geomorphic assessments based on the geometric and volumetric analyses for the Mississippi River reaches is tabularized in Table 3. This general assessment represents the most reasonable

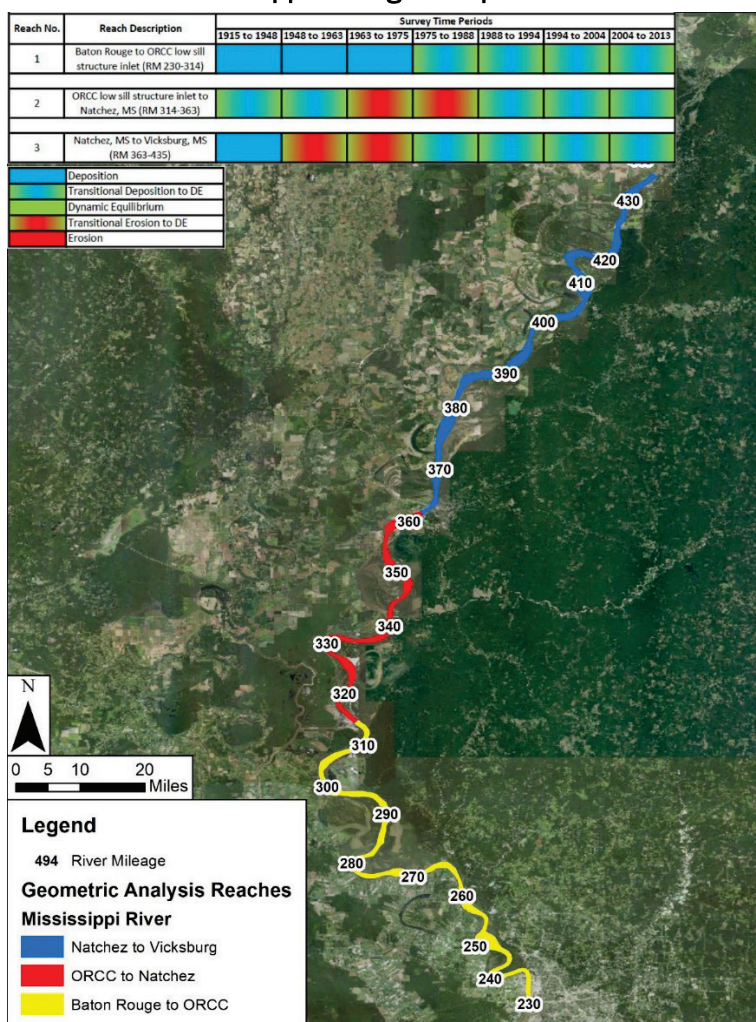
reconciliation of trends based on all the geometric parameters and channel volume. A map with the general assessment and associated reaches is shown in Figure 198.

Table 4. General geomorphic assessment for Mississippi River reaches based on geometric parameter and volumetric analyses.

General Geomorphic Assessment by Reach Based on Geometric Parameter and Volumetric Analyses								
Reach No.	Reach Description	Survey Time Periods						
		1915 to 1948	1948 to 1963	1963 to 1975	1975 to 1988	1988 to 1994	1994 to 2004	2004 to 2013
1	Baton Rouge to ORCC low sill structure inlet (RM 230-314)							
2	ORCC low sill structure inlet to Natchez, MS (RM 314-363)							
3	Natchez, MS to Vicksburg, MS (RM 363-435)							

	Deposition
	Transitional Deposition to DE
	Dynamic Equilibrium
	Transitional Erosion to DE
	Erosion

Figure 198. General Mississippi River geomorphic assessment with reaches.



4.5 Atchafalaya River geomorphic reaches

The geomorphic assessment of the Atchafalaya River reaches based on the geometric parameters and volumetric analyses is conducted for the survey time periods for this assessment (1976 to 2019). The results from the 1951 MRC report will be included in the general geomorphic assessment presented later in this report.

4.5.1 Old River to head of WBPC (RM 0–56)

The variability in trends displayed for this reach is very mild, and in general the reach is in or near a state of dynamic equilibrium for the survey time period. The trends of cross-sectional area, hydraulic depth, and channel volume indicate slight deposition to dynamic equilibrium from 1976 to 1998, and slight erosion to dynamic equilibrium from 1998 to 2019. The trend in channel width shows very slight increase to no change for the entire time period 1976 to 2019. Overall, this reach has been generally stable over the entire time period, with very slight periods of erosion and deposition (Table 5).

4.5.2 Head of WBPC to Grand Lake (RM 56–101)

This reach basically encompasses the entirety of the WBPC, constructed in the mid to late-1930s. In comparison to the previous reach, the reach from the head of WBPC to Grand Lake has demonstrates greater morphological change over the time period 1976 to 2019. The cross-sectional area, hydraulic depth and channel volume indicate a generally consistent trend of erosion for the entire time period 1976 to 2019, but with slight erosion to dynamic equilibrium for the latter part of the period from 2010 to 2019. Channel width changes are generally slight but consistently increasing over the survey time periods, with periods of little to no change. Based on the observed trends in hydraulic depth and width, it appears the observed increase in channel area and volume are likely due to proportional changes in depth and width, with changes in width being slightly predominant (Table 5).

4.5.3 Grand Lake to Morgan City, LA (RM 101–121)

This reach is characterized by wider, lake-like sections that are subject to tidal influences. In addition, this reach is also subject to periodic

maintenance dredging activities. The extent of survey data for some periods may not encompass the full channel area. As a result, the geometric parameters for this reach are somewhat more variable, as demonstrated by the generally broader interquartile range (IQR) of the box-and-whisker plots. The general trends in cross-sectional area and channel volume indicate little change to slightly depositional, while the trends in hydraulic depth indicate little change to slight erosion. Trends in channel width indicate little change to slightly decreasing over the survey periods. Overall, this reach is characterized by mild variability in channel geometry, but generally in or near dynamic equilibrium (Table 5).

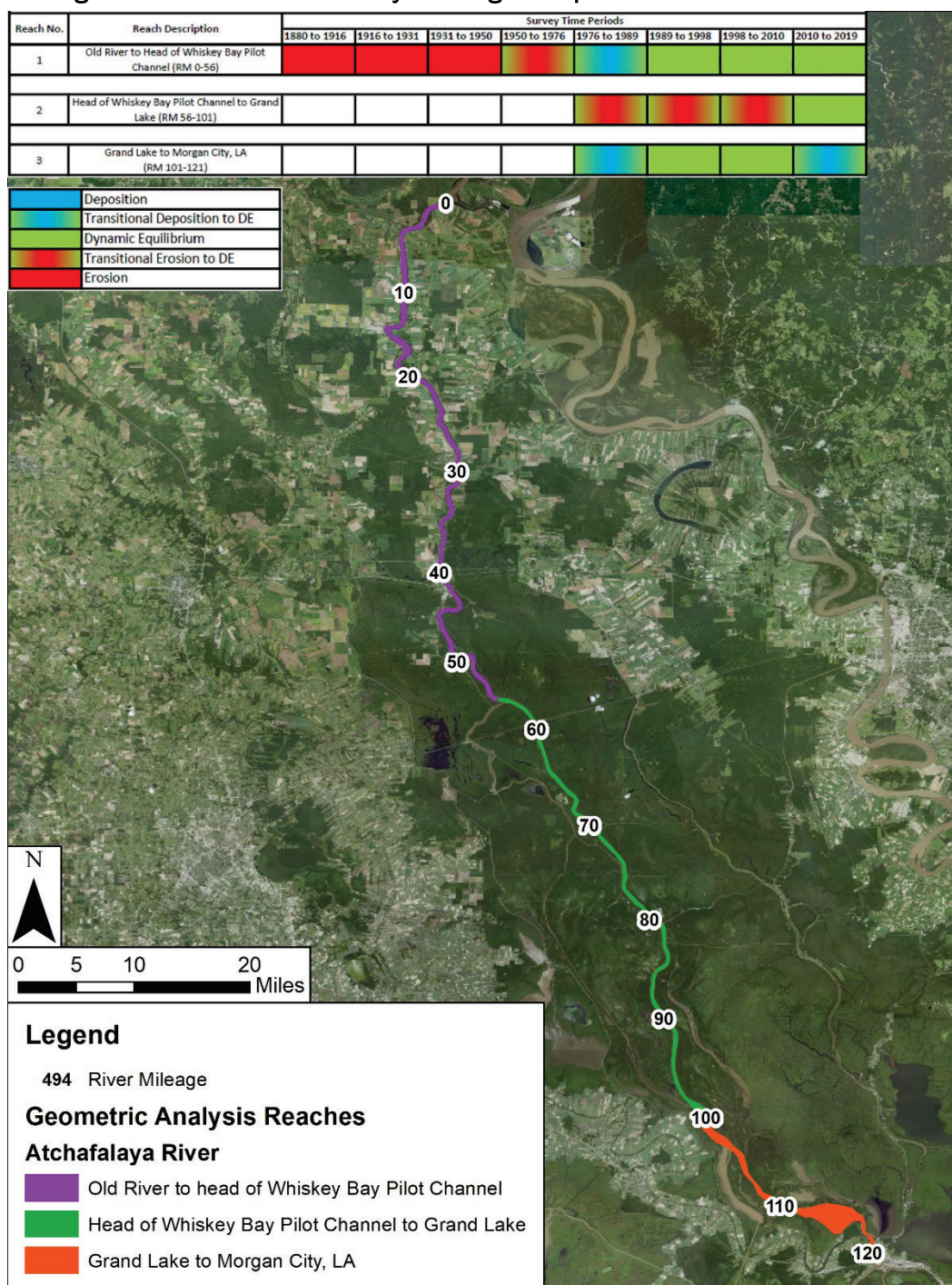
The general geomorphic assessments based on the geometric and volumetric analyses for the Atchafalaya River reaches is tabularized in Table 5. This general assessment is based on the results of the current assessment analyses as well as incorporating the findings of the 1951 MRC report, where applicable. This provides the most long-term assessment for the reach as possible and gives greater insight into the historical morphology of the Atchafalaya River. Note that the 1951 report findings are available only for the reach from Old River to the head of WBPC. A map with the general assessment and associated reaches is shown in Figure 199.

Table 5. General geomorphic assessment for Atchafalaya River reaches based on geometric parameter and volumetric analyses.

General Geomorphic Assessment by Reach Based on Geometric Parameter and Volumetric Analyses									
Reach No.	Reach Description	Survey Time Periods							
		1880 to 1916	1916 to 1931	1931 to 1950	1950 to 1976	1976 to 1989	1989 to 1998	1998 to 2010	2010 to 2019
1	Old River to Head of Whiskey Bay Pilot Channel (RM 0-56)								
2	Head of Whiskey Bay Pilot Channel to Grand Lake (RM 56-101)								
3	Grand Lake to Morgan City, LA (RM 101-121)								

	Deposition
	Transitional Deposition to DE
	Dynamic Equilibrium
	Transitional Erosion to DE
	Erosion

Figure 199. General Atchafalaya River geomorphic assessment with reaches.



4.6 Old River geomorphic reaches

The geomorphic assessments of the Old River reaches are based on the geometric parameter and volumetric analyses conducted for the survey time periods 1963 to 2013, which encompass the entire history of the

constructed ORCC channels. Because of the relative short extents of the ORCC channels, the observed changes in geometry are likely to be influenced by local effects from the structures, such as turbulence, flushing activities and operation alterations. Therefore, it may be difficult to attribute observed changes to reach-scale morphology or local effects.

4.6.1 Hydropower plant inflow and outflow channels

Observed trends of cross-sectional area, hydraulic depth and channel volumes indicate the inflow and outflow channel for the hydropower plant (hydropower plant began operation in 1990) experienced erosion from 1994 to 2004, with the outflow channel showing the most erosion (Table 6).

Channel volume for the outflow channel nearly doubled referenced to the LWRP and increased approximately 30% referenced to bankfull conditions. This time period encompassed the majority of the observed channel adjustment, as trends from 2004 to 2013 showed little to no change. Of interest is the relative size to which the channels have adjusted, with the outflow channel volume increasing to approximately twice that of the inflow channel.

4.6.2 Low sill structure inflow and outflow channels

Observed trends in cross-sectional area, hydraulic depth, and channel volume indicate the inflow channel for the low sill structure has generally experienced deposition from 1963 to 2013 (Table 6). Cross-sectional area and hydraulic depth for the inflow channel have decreased over the time period, and widths have slightly decreased as well.

Conversely, the low sill structure outflow channel from the structure to the auxiliary structure outflow channel has undergone general erosion over the time period, although the trends in geometric parameters and channel volume are more variable. The variability in observed channel geometry may be a result of the change in operation frequency of the low sill structure since the auxiliary structure (1986) and hydropower plant (1990) were placed in operation. Note that this segment of the outflow channel conveys flows released from the low sill structure. The remainder of the ORCC outflow channel will be addressed later as a single reach.

4.6.3 Auxiliary structure inflow and outflow channels

Based on the observed trends of the geometric parameters and channel volume, the inflow channel of the auxiliary structure (placed in operation in 1986) has demonstrated periods of deposition and erosion over the survey time periods. This is most likely due to the inflow channel acting as a sediment trap and the ensuing sediment flushing activities. There is some uncertainty in the trends, however, as the channel volume tends to show less variability than the other geometric parameters. In general, the auxiliary structure outflow channel indicates little change over the time period and is at or near a state of dynamic equilibrium (Table 6).

4.6.4 Full outflow channel

The original outflow channel below the low sill structure has been divided into three segments since the construction of the auxiliary structure (1986) and the hydropower plant (1990). The segments are the low sill structure to the confluence of the auxiliary structure outflow channel, the auxiliary outflow channel to the confluence of the hydropower plant outflow channel, and the hydropower outflow channel to the Red River. Since the addition of the structures, these three segments of the outflow channel have been subject to various combinations of water and sediment loads, dependent on which structure(s) is in operation. Only the segment from confluence of the hydropower plant outflow channel to the Red River has experienced the total load of water and sediment passed through the ORCC.

For the full outflow channel from the hydropower outflow channel to the Red River, the general trend over the time period 1963 to 2013 has been a slowing rate of erosion to approaching the point of dynamic equilibrium, with the exception 1988 to 1994 when slight deposition was observed. Overall, the channel volume of the full outflow channel referenced to bankfull conditions has increased approximately 75% from 1963 to 2013 (Table 6).

The general geomorphic assessment based on the geometric and volumetric analyses for the Old River reaches is shown in Table 6. As mentioned earlier, the channels of the ORCC are greatly influenced by local effects from the structures and variations in structure operation activities. Attribution of observed changes in channel geometry to either local effects or long-term, reach-scale morphology trends is problematic. A

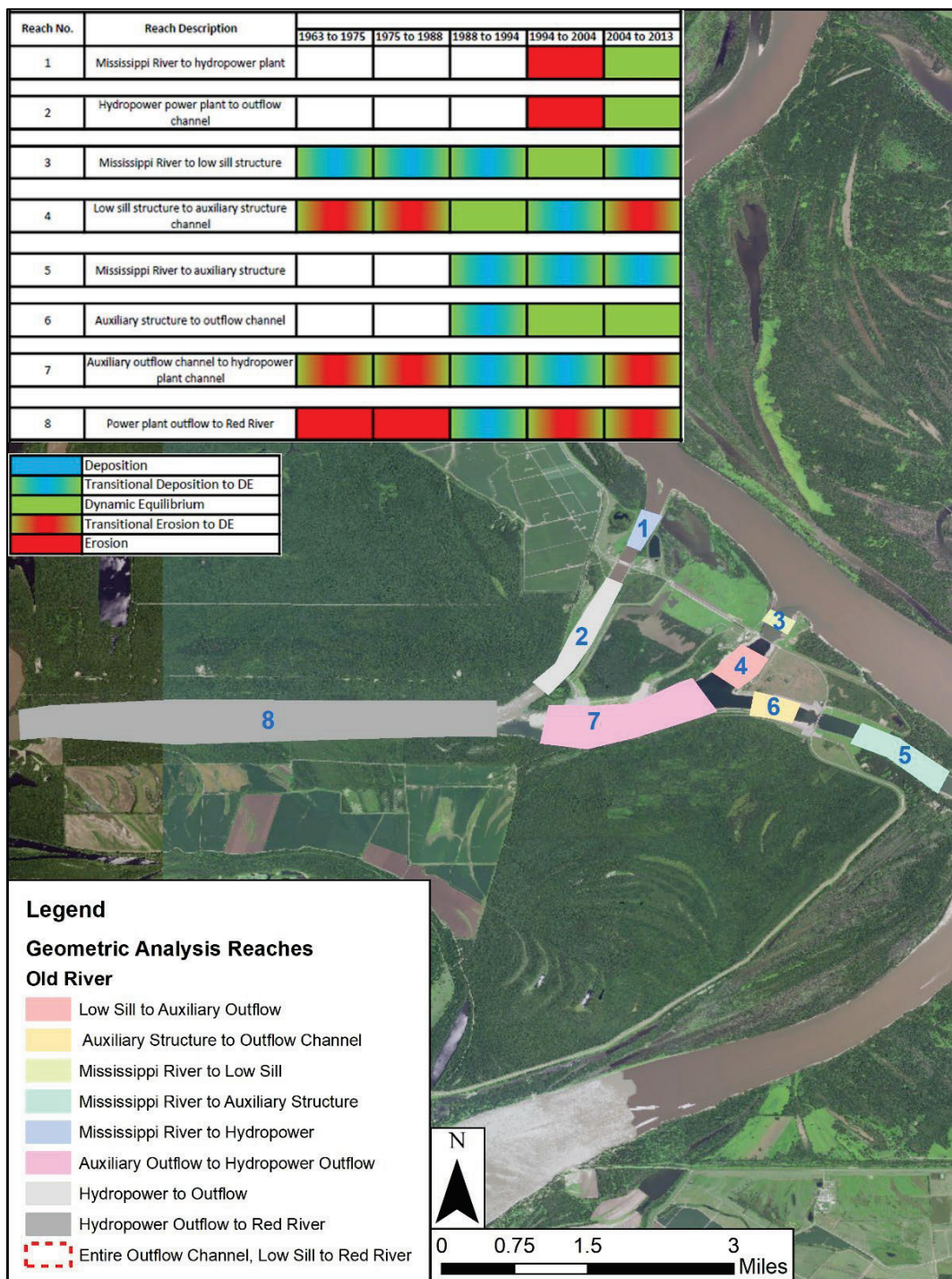
map with the general assessment and associated reaches is shown in Figure 200.

Table 6. General geomorphic assessment for Old River reaches based on geometric parameter and volumetric analyses.

General Geomorphic Assessment by Reach Based on Geometric Parameter and Volumetric Analyses						
Reach No.	Reach Description	1963 to 1975	1975 to 1988	1988 to 1994	1994 to 2004	2004 to 2013
1	Mississippi River to hydropower plant					
2	Hydropower power plant to outflow channel					
3	Mississippi River to low sill structure					
4	Low sill structure to auxiliary structure channel					
5	Mississippi River to auxiliary structure					
6	Auxiliary structure to outflow channel					
7	Auxiliary outflow channel to hydropower plant channel					
8	Power plant outflow to Red River					
9	Entire outflow channel, low sill structure to Red River					

	Deposition
	Transitional Deposition to DE
	Dynamic Equilibrium
	Transitional Erosion to DE
	Erosion

Figure 200. General Old River geomorphic assessment with reaches.



5 Conclusions and Summary

A channel geometry analysis was conducted for Old River, the Mississippi River, and the Atchafalaya River as part of an overall geomorphic assessment conducted for the OMAR Assessment. The results of the geometry analysis assist in determining the spatial and temporal morphological changes of the rivers that have been influenced by the operation of the ORCC in east-central Louisiana. Historical hydrographic survey data ranging from 1915 to 2019 were used in GIS to create river channel geometric models of channel bathymetry for each survey period to inform the analysis. Geometric parameters for channel cross sections and volume polygons were computed for each survey period and evaluated for morphological trends. Additionally, the geometric parameters for the Atchafalaya River were used to extend the channel geometry analyses from the 1951 MRC Report on the Atchafalaya River, which was the primary catalyst for the initial development of the ORCS.

Geometric parameters computed for this assessment include cross-sectional area, width, hydraulic depth, computed conveyance and W/D ratio. These parameters were computed at 1 mi intervals for the Mississippi River and Atchafalaya River and at specific locations for the Old River channels. The parameters were computed referenced to a low water and bankfull condition. Channel volume was computed for 1 mi segments of the channel referenced to low water and bankfull conditions for the Mississippi River and Atchafalaya River, where the volumes were computed for the entire inflow and outflow channel segments.

The computed geometric and volumetric parameters were grouped by geomorphic reaches established for each river, and statistical analyses were conducted to determine trends in observed values. Box-and-whisker plots were created for each geomorphic reach to illustrate the tendencies in median values and the interquartile range of the data from survey to survey. Trend plots were created from the box-and-whisker plot data that show the trends in median values over time. For the Atchafalaya River, the computed data were used to extend the analyses of the 1951 MRC report for the average cross-sectional area, average width, and average depth parameters to form a lengthier, comprehensive assessment of the channel changes observed in the Atchafalaya River system.

The trends indicated by the geometric parameter and volumetric analyses were used to formulate a general geomorphic assessment of each reach for the rivers in the assessment area. These assessments will be integrated with other analyses conducted as part of the OMAR Assessment to formulate a comprehensive geomorphic assessment for the river reaches. The overall geomorphic assessments will provide insight into the spatial and temporal trends of the river systems that may be attributed to construction and operation of the ORCC. The overall geomorphic assessment will also inform other OMAR Assessment tasks such as numerical hydraulic and sediment transport modeling.

The general geomorphic assessments for the reaches based on the geometric parameter and volumetric analyses were broadly categorized as depositional, erosional, and dynamic equilibrium, with transitional phases from depositional or erosional to dynamic equilibrium. Assessments were made for each survey time period, with the general long-term trends broadly classified as follows:

- Mississippi River, Baton Rouge, LA, to ORCC: depositional/dynamic equilibrium
- Mississippi River, ORCC to Natchez, MS: depositional/dynamic equilibrium
- Mississippi River, Natchez, MS, to Vicksburg, MS: depositional/dynamic equilibrium
- Atchafalaya River, Old River to head of WBPC: erosional to approximately 1950 (based on 1951 MRC report), then erosional/dynamic equilibrium
- Atchafalaya River, head of WBPC to Grand Lake: erosional/dynamic equilibrium
- Atchafalaya River, Grand Lake to Morgan City, LA: depositional/dynamic equilibrium
- Old River, Mississippi River to hydropower plant: erosional (1994–2004) to dynamic equilibrium
- Old River, hydropower plant to outflow channel: erosional (1994–2004) to dynamic equilibrium
- Old River, Mississippi River to low sill structure: depositional/dynamic equilibrium
- Old River, low sill structure to auxiliary structure channel: erosional/dynamic equilibrium

- Old River, Mississippi River to auxiliary structure: depositional/dynamic equilibrium
- Old River, auxiliary structure to outflow channel: depositional/dynamic equilibrium
- Old River, auxiliary structure outflow channel to hydropower plant outflow channel: depositional/dynamic equilibrium to erosional/dynamic equilibrium
- Old River, power plant outflow channel to Red River: erosional to dynamic equilibrium.

Appending the Atchafalaya River geometric data for the reach from Old River to head of WBPC to the data from the 1951 MRC report on the Atchafalaya River provides the opportunity to extend the findings of the 1951 report to the most current period. This provides valuable insight into the long-term morphology of the upper Atchafalaya River, both prior and subsequent to the initial construction of the ORCS. The 1951 report was the basis for initiation of the planning, design, and construction of the original ORC structures. The results of the 1951 report indicate the upper Atchafalaya River channel was consistently enlarging through erosion from 1880 to 1950. The extension of the assessment results through the addition of the geometric data from 1976 to 2019 for the current assessment indicate channel enlargement continued in the interim period between reports, but at a reduced rate. The current report data illustrates the river channel to be in or near a state of dynamic equilibrium for the period 1976 to 2019.

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Appendix A: Mississippi River Geometric Data Tables

Summary for cross sections at Low Water Reference (LWRP)

RM	Cross sectional area (ft2)								Width			
	1915	1948	1963	1975	1988	1994	2004	2013	1915	1948	1963	1975
230	94,138	91,979	84,571	78,068	72,147	78,723			2450	2700	2700	2750
231	102,755	96,307	90,489	87,553	78,535	86,635	79,570	88,335	2700	2800	2700	2800
232	104,655	107,081	89,772	88,098	84,868	93,545	91,004	92,227	1950	1900	2100	2050
233	104,775	105,182	94,801	81,501	100,115	87,737	86,334	92,988	2250	2400	2400	2500
234	94,700	109,181	92,131	87,006	88,953	89,722	82,605	89,168	2150	2300	2050	2150
235	167,490	237,105	124,245	222,475	195,803	122,265	105,378	135,789	2800	3150	2100	2500
236	90,598	98,468	85,852	80,534	71,557	75,989	80,084	77,760	1700	2000	1950	2100
237	89,547	98,351	81,642	75,483	75,004	76,488	75,799	70,953	2200	2300	2300	2300
238		97,249	85,228	74,091	76,049	70,517	70,140	68,670		1900	1900	1950
239		100,017	89,202	83,693	74,131	75,285	75,198	76,902		1850	1950	2050
240		135,501	120,488	123,900	137,882	99,949	116,541	108,296		1700	1750	1750
241		131,372	78,881	91,406	84,035	78,847	101,548	89,213		2700	2600	2700
242		92,087	79,154	74,353	75,910	76,657	78,928	77,611		2550	2150	1950
243		95,827	82,434	76,038	74,583	70,697	75,891	78,150		1900	1600	1650
244		98,390	89,266	80,039	82,029	71,513	77,542	73,793		1800	1800	1900
245		94,471	72,811	70,213	78,210	71,949	70,221	74,690		2450	1800	1950
246		84,468	85,676	70,461	78,808	73,436	90,546	76,421		2350	2650	2550
247		78,337	67,499	50,782	37,429	38,022	53,254	51,519		2500	2050	2200
248		77,661	64,361	54,236	37,149	38,794	46,168	41,329		1800	1900	2100
249		66,050	83,562	97,097	84,483	62,944	72,034	76,281		1400	1500	1450
250		73,622	51,237	45,565	52,390	55,105	62,857	62,241		1800	1600	1150
251		47,867	58,441	46,640	38,111	48,537	56,790	54,840		1900	2850	2500
252		60,756	58,117	42,244	36,972	48,656	51,193	54,443		3050	2350	2650
253		80,793	77,656	79,749	85,402	78,549	71,571	72,943		3400	2450	2400
254		97,426	100,535	125,121	88,138	69,092	71,740	72,163		2150	2000	2000
255	107,635	239,357	125,779	85,525	82,409	70,395	67,233	68,008	1600	2800	2500	2200
256	83,031	85,375	71,841	68,795	68,946	66,534	67,192	59,850	1850	2800	2950	3150
257	108,907	93,176	84,147	103,110	95,686	108,119	93,665	93,108	3900	2950	2600	2450
258	88,795	74,666	67,808	51,586	55,669	62,333	57,505	53,130	5250	2850	2600	3000
259	78,213	58,873	67,098	54,529	55,128	53,052	51,600	47,046	3600	3650	3550	3700
260	89,411	80,899	91,848	73,441	73,658	75,324		80,213	2550	2850	2850	3000
261	83,323	84,756	73,722	78,652	73,811	98,219		114,852	2300	2750	2750	2800
262	94,191	85,371	81,343	86,430	89,096	88,769		86,922	2050	2300	2350	2300
263	85,969	91,311	82,696	81,154	69,217	79,996		70,639	1300	1650	1550	1600
264	93,533	86,585	72,038	73,406	52,169	55,146	53,764	51,150	2100	1650	2050	2250
265	51,272	102,192	70,950	51,543	58,672	51,788	57,221	56,789	4000	3100	3200	2050
266	87,014	73,628	66,878	57,265	57,900	60,253	57,080	56,093	3800	3300	3300	3400
267	97,227	80,512	68,281	62,644	70,111	68,627	66,189	62,687	2750	2650	2750	2800
268	93,904	89,106	78,606	84,652	81,682	77,393	71,027	78,166	2100	2350	2150	2100
269	102,501	98,234	79,551	76,880	81,884	78,937	76,824	77,674	1850	1800	1550	1600
270	102,350	107,375	81,480	92,601	81,796	75,350	70,054	74,947	2000	2000	2350	2250
271	93,122	67,336	53,366	44,480	55,248	55,142	62,294	62,202	1750	3050	2000	2000
272	60,743	44,350	56,172	44,558	63,206	53,231	65,325	52,492	1450	1500	2550	2400

273	55,330	68,784	59,992	46,092	50,022	50,252	56,504	54,208	2600	4300	3450	2800
274	81,705	80,452	73,058	69,127	65,570	69,276	67,349	64,968	3000	2650	2300	2150
275	79,727	69,708	55,620	53,209	54,116	62,615	62,673	57,388	1850	1900	1700	1700
276	79,701	75,985	62,086	56,764	53,885	62,699	54,919	56,005	1950	1950	2050	2400
277	90,002	84,625	69,633	64,690	65,853	69,595	61,113	57,803	2050	2250	2400	2500
278	76,084	87,242	72,135	71,594	78,491	71,175	68,833	64,208	1500	1800	1900	1900
279	75,148	81,747	80,449	74,317	80,895	83,728	73,787	62,483	1500	1450	1300	1300
280	94,260	86,038	77,761	71,219	82,100	87,223	82,370	80,771	2200	1600	2450	2850
281	103,625	81,005	80,628	86,276	95,679	98,631	85,150	84,106	2600	2400	2200	2250
282	88,992	80,084	69,051	66,317	63,089	67,027	67,063	58,612	2000	1900	1750	1650
283	98,381	92,182	90,014	83,887	73,436	87,724	77,265	72,950	1900	1850	1900	2100
284	109,792	99,880	76,653	80,894	76,178	77,936	76,100	72,528	2100	1800	1750	2050
285	84,045	75,416	57,436	63,036	65,056	67,610		66,680	1950	1700	1600	1700
286	67,959	54,362	58,474	52,833	53,091	53,635		49,540	3000	2100	2200	2700
287	78,075	68,436	70,133	57,175	63,617	55,298		54,541	3550	3550	3500	2650
288	93,724	84,060	60,225	50,901	59,791	62,532		56,958	3100	2950	2250	2250
289	95,761	81,314	72,420	61,266	68,758	67,415	62,683	64,062	2650	2450	2250	2300
290	97,904	87,420	68,894	61,640	68,076	72,455	60,443	54,423	1850	1900	1700	2000
291	88,209	76,178	55,409	51,668	52,950	65,472	56,230	51,730	1500	1950	2050	2150
292	74,211	69,732	51,030	41,039	61,524	67,183	61,218	53,201	1700	1900	1650	1550
293	70,751	53,546	57,643	51,906	75,753	68,907	55,294	39,929	2550	3100	3300	2750
294	92,346	51,321	58,382	51,918	59,398	66,460	56,329	48,119	3550	3050	3450	2850
295	85,856	54,356	50,608	49,985	48,346	56,292	47,722	38,434	2900	2950	2150	2100
296	81,262	73,222	59,980	53,411	54,507	59,227	54,998	50,640	2900	3200	2650	2050
297	91,033	79,730	66,978	53,853	71,575	58,093	63,018	63,442	2600	2750	2150	1800
298	151,791	88,703	57,701	57,493	65,084	47,828	78,685	76,263	2800	2000	1850	2600
299	56,729	48,416	51,068	30,565	44,151	34,190	58,925	38,196	3700	3100	3750	3250
300	78,325	66,343	48,302	44,955	31,134	53,286	56,316	47,959	4600	3650	4350	3900
301	74,085	59,362	45,346	50,093	38,857	43,518	55,688	64,418	3900	3300	2700	3600
302	75,028	77,206	57,465	67,886	62,353	68,606	65,041	65,565	5000	3350	2750	3350
303	123,942	57,951	79,049	118,228	107,714	85,450	57,989	61,957	6150	1800	1900	2500
304	96,582	110,217	96,293	73,370	64,493	56,153	51,869	48,887	3200	2550	3050	3350
305	109,238		78,674	51,765	38,515	40,443	46,143	34,266	2750		2950	2450
306	114,744		71,316	50,862	45,461	49,845	50,551	42,943	2150		3550	3600
307	92,228		71,304	56,317	48,330	57,558	59,840	58,338	2250		2650	2750
308	104,056		74,606	64,061	57,626	72,560	65,227	62,402	3450		2300	2200
309	122,662		71,593	68,479	62,080	72,472	62,354	65,277	2900		2200	2100
310	113,383		81,506	75,619	72,623	84,962	66,154	60,673	2050		2100	1850
311	108,362		85,106	72,010	62,455	88,795	64,328	55,953	2000		2250	1550
312	141,685		92,044	64,301	52,460	84,460	56,744	52,054	3500		3050	3250
313	83,262		68,804	45,771	47,644	73,063	53,192	51,513	2350		3450	2300
314	88,683		72,996	58,353	68,883	83,237	61,464	59,763	3050		3100	2900
315	86,617	82,243	92,557	123,702	101,247	107,450	77,047	73,702	3650	3400	2700	2250
316	100,660	112,561	88,339	102,573	60,643	92,823	76,279	65,870	2850	2600	1750	1650
317	98,600	120,962	80,190	97,760	88,516	92,743	67,258	81,918	2000	2450	1600	1900
318	94,031	112,580	98,451	108,749	102,460	110,481	93,035	82,757	1600	1850	2100	2450
319	86,591	116,371	89,597	111,217	117,041	115,422	98,693	88,852	1800	2900	2600	2650

320	104,352	75,453	71,672	92,625	75,717	89,424	80,305	80,044	3050	3050	2650	2800
321	123,121	80,006	65,529	99,541	77,100	89,519	90,110	90,047	3800	3050	3150	2400
322	149,649	94,251	62,986	72,341	67,377	70,232	73,177	64,477	2400	2350	2100	2650
323	89,408	114,093	50,748	56,237	70,877	65,151	73,206	67,816	3150	2500	2100	2700
324	84,275	47,043	68,145	49,407	65,486	62,898	69,298	65,521	3900	3550	2600	2650
325	88,996	53,960	64,374	56,620	72,339	61,478	62,434	47,976	2950	3750	2450	2450
326	88,828	81,451	56,079	69,828	86,684	77,835	79,647	66,189	2450	3250	3000	3400
327	87,428	68,104	76,149	80,405	88,586	79,389	84,447	84,543	2000	2200	2250	2450
328	102,579	71,486	78,757	106,170	87,274	99,162	72,865	86,100	2500	2000	2000	1750
329	89,298	84,868	91,628	84,532	86,377	69,272	87,375	60,319	1900	1950	1550	1200
330	74,527	67,139	68,417	63,219	82,817	99,619	56,383	62,549	1450	1650	1250	2450
331	64,434	62,487	74,745	101,174	95,903	103,044	72,633	62,371	1400	3150	3900	5400
332	78,846	77,301	66,336	89,319	85,888	82,674	70,227	52,131	2400	3200	3500	4050
333	96,772	79,227	71,391	92,811	90,629	88,461	75,688	71,662	2600	2200	2950	3100
334	86,271	74,816	71,911	98,545	96,080	94,934	75,988	80,806	2250	2750	2850	2350
335	91,764	74,204	77,352	86,105	72,487	77,523	67,961	73,210	2150	2650	2650	2600
336	85,870	85,695	76,741	73,440	55,999	70,498	58,830	61,245	2150	2750	2100	2850
337	104,982	54,508	64,654	72,348	61,588	53,188	52,070	51,740	3200	3050	1500	3800
338	95,112	83,840	90,321	80,421	68,497	41,338	61,632	60,370	2950	3900	2950	4300
339	103,666	63,439	73,731	73,094	72,958	42,937	67,149	60,014	2600	3750	3100	3600
340	105,505	72,822	74,299	83,884	75,682	43,303	67,373	65,205	2200	3650	2700	3250
341	92,024	82,179	72,430	103,021	83,999	78,403	76,964	68,578	1800	2200	2500	3100
342	104,221	82,291	90,615	105,212	85,771	72,249	71,898	77,867	2950	1750	2000	2250
343	91,946	90,749	82,007	98,246	97,601	94,234	93,768	115,845	2350	1750	1850	2250
344	95,267	112,641	97,434	130,756	56,920	74,666	77,996	83,794	2650	2000	2400	2500
345	72,154	65,136	98,557	86,014	81,774	59,283	68,282	58,616	2000	1800	1950	2050
346	92,368	66,561	77,047	95,961	51,391	54,886	58,564	61,071	1650	2000	2000	2500
347	84,421	74,778	76,643	81,166	72,059	79,925	71,380	60,988	3150	2000	3050	3350
348	69,007	75,284	66,129	65,390	71,226	65,787	74,456	76,753	3950	3000	3400	2300
349	78,012	62,880	65,735	58,067	63,008	62,769	46,374	59,622	4100	2750	2900	1900
350	67,327	41,808	65,875	57,644	58,367	62,090	61,941	55,612	4400	2050	2900	3000
351	69,868	73,759	62,610	46,720	59,389	44,686	53,314	44,574	5350	2000	3100	3750
352	71,680	83,082	61,446	51,838	65,121	51,079	56,318	42,274	4400	2650	3500	4000
353	74,418	76,199	61,988	58,465	65,083	44,894	66,649	57,513	4550	2750	3050	3700
354	70,226	75,714	64,886	69,974	80,765	78,322	75,122	74,306	3950	2750	2500	2900
355	72,260	70,822	70,594	68,361	79,612	83,800	68,750	83,236	4500	3250	2600	2250
356	96,609	59,326	97,624	90,821	73,936	86,917	75,135	79,015	4000	1850	2450	1800
357	58,338	45,415	69,383	66,948	94,220	68,801	98,888	91,237	5550	3700	3200	3950
358	67,325	34,587	62,088	63,732	73,400	52,466	59,140	42,812	4800	3750	3950	4950
359	77,112	63,393	65,813	82,861	85,297	76,392	70,212	66,893	3850	3650	3950	3900
360	77,868	85,177	69,380		87,602	76,410	69,023	67,240	2850	3500	3550	
361	83,139	88,334	73,771		88,683	79,179	74,664	70,375	3000	3300	3350	
362	98,724	90,417	82,646		90,737	90,927	77,413	88,965	2350	2650	2750	
363	95,447	88,218	84,326	93,484	82,469	74,362	70,261	72,997	1750	2400	2300	2450
364	94,076	78,328	91,398	110,132	91,027	89,656	75,241	83,631	1800	2750	3150	3200
365	77,626	91,413	90,765	115,439	92,765	95,319	82,090	90,510	2800	2400	2400	2300
366	75,714	92,218	92,477	110,755	88,908	83,811	81,811	83,943	2250	1400	1600	1750

367	87,295	81,937	86,546	106,405	77,843	80,397	76,622	81,074	2450	1800	1950	2300
368	87,263	60,612	61,816	78,665	69,566	62,325	57,988	70,054	2150	2300	2250	3400
369	84,753	66,979	61,265	81,200	80,072	83,082	70,336	80,113	2400	4250	3600	3600
370	77,510	60,558	67,698	79,305	87,408	96,529	82,129	87,943	3300	2900	2750	3350
371	75,143	69,326	73,523	81,551	74,628	84,957	76,380	79,709	3100	3850	2500	2300
372	85,261	76,305	65,814	87,398	72,032	81,814	71,771	71,231	2900	3400	2100	2150
373	81,481	67,861	62,570	95,643	64,432	78,277	55,096	54,337	3300	3150	2350	2950
374	78,449	61,075	77,880	82,921	61,356	62,122	42,684	49,412	2400	1700	3050	3150
375	73,065	88,139	61,686	79,449	64,743	66,288	61,188	58,982	2400	3350	2300	3350
376	48,510	83,123	59,960	55,253	58,976	49,451	52,746	56,475	1750	3950	2500	2950
377	52,794	47,095	52,421	47,910	59,532	53,133	52,604	52,528	4750	2400	2800	2100
378	70,178	54,783	59,670	46,229	56,201	45,776	47,394	57,750	3500	1850	3600	3500
379	72,082	63,194	76,322	68,370	84,297	60,846	62,955	55,640	3400	2450	4750	4900
380	71,751	63,092	74,241	67,285	87,075	59,791	61,027	50,857	3250	3450	4350	4500
381	70,094	49,063	77,369	86,399	83,458	94,427	76,527	73,959	3350	2550	2800	2900
382	86,200	82,961	66,556	89,592	84,092	93,132	70,180	85,660	2300	2500	1900	2250
383	75,704	63,333	54,334	62,519	61,111	69,174	62,566	68,861	1800	1600	1400	1300
384	54,244	55,682	66,225	73,569	74,879	53,402	57,697	58,344	1550	2450	2800	1650
385	52,220	57,843	66,782	60,320	70,289	55,657	56,855	54,848	1600	2950	3050	3250
386	50,504	64,384	63,412	60,927	71,868	70,665	62,806	59,310	2250	2800	3150	2850
387	51,724	72,254	65,538	64,243	69,980	65,179	52,112	62,760	2000	2900	3200	2600
388	71,587	78,750	75,434	38,329	64,496	52,895	58,073	41,312	3200	3350	5450	2450
389	92,753	65,362	75,810	85,171	66,963	50,109	65,940	57,883	1400	4750	5750	5400
390	70,823	57,717	75,128	77,175	79,439	84,265	105,336	89,130	2500	2950	4500	2750
391	75,597	49,089	71,371	87,795	61,389	51,918	63,594	66,420	1600	2600	2900	3450
392	99,661	48,356	49,165	74,678	65,808	60,154	65,353	63,345	2400	2450	2100	2600
393	86,687	54,948	55,566	61,825	58,248	50,243	48,919	48,841	2450	2750	3200	3400
394	76,416	65,261	64,521	95,619	66,700	62,240	64,727	60,901	2100	3850	3200	5250
395	58,273	85,739	78,888	90,218	85,147	75,009	83,773	86,647	1350	3500	4000	3700
396	80,044	84,685	87,030	113,925	83,985	105,402	91,313	96,895	3300	2650	3100	2600
397	58,732	84,479	97,041	94,736	71,864	79,991	74,428	92,660	2950	2200	1800	2050
398	77,468	82,998	92,786	93,362	82,638	74,754	80,014	69,365	2550	2300	1900	2350
399	93,796	64,007	79,116	100,823	62,489	74,886	57,801	63,566	1850	1650	2000	2800
400	70,620	76,084	85,094	78,723	64,221	73,796	60,382	64,307	1900	3350	3450	3100
401	56,135	58,917	85,287	85,053	64,166	71,001	74,717	68,310	2050	3000	2950	2900
402	86,920	72,154	69,581	64,948	61,274	53,883	52,445	59,280	2550	2700	2400	3200
403	86,319	73,819	60,567	57,112	60,080	44,381	55,899	58,312	2100	3250	2200	2150
404	81,922	72,771	72,308	66,854	62,065	60,037	57,567	59,933	1650	3550	2450	3150
405	77,874	64,605	72,049	99,888	72,446	110,946	82,339	93,154	2500	2500	3000	3800
406	92,535	74,144	75,821	83,175	83,991	83,587	78,065	73,997	3400	2500	2900	3350
407	66,806	66,590	70,383	89,091	91,326	83,534	83,257	91,843	3200	3000	2550	2750
408	72,245	52,465	83,228	70,562	66,119	65,332	75,464	76,732	1750	2600	3550	2600
409	73,476	53,151	68,527	49,196	61,452	45,211	49,520	52,513	2700	4300	3200	2250
410	84,429	51,785	74,069	65,118	76,974	54,999	72,114	65,450	1650	3900	3550	3600
411	106,059	59,325	88,470	94,860	81,257	60,606	64,419	58,335	2650	3450	4850	4950
412	68,155	61,987	78,013	93,426	79,706	81,455	84,480	79,133	2050	3150	2900	2150
413	62,952	74,128	67,379	71,799	85,669	99,758	81,517	89,934	2750	2400	2050	1850

414	73,627	83,186	76,879	64,875	78,872	67,636	85,233	69,576	2150	2100	2800	1500
415	120,315	14,510	68,752	42,532	28,693	55,422	59,211	53,576	2550	1550	2200	2700
416	31,786	43,060	66,205	76,179	90,230	107,523	88,113	87,881	1000	1800	3000	3250
417	43,780	30,344	66,850	83,861	78,840	74,420	83,364	75,967	1700	3650	2500	1950
418	40,634	56,633	56,302	48,808	66,759	63,961	67,752	69,849	1750	2650	1450	1250
419	34,280	61,278	59,581	50,815	53,259	58,292	59,885	47,675	1350	1900	2550	1850
420	29,222	53,829	58,359	76,066	61,732	73,279	61,282	50,780	1300	1650	2750	3050
421	24,138	68,593	60,490	100,662	77,473	81,797	70,854	75,212	1100	1800	3100	3200
422	36,133	68,226	55,481	67,192	63,464	56,937	61,417	54,909	1950	2500	1850	2100
423	36,109	48,980	44,582	49,019	60,551	40,336	52,333	45,959	1750	2100	1850	2300
424	38,596	45,701	58,632	67,207	61,349	49,544	69,317	57,418	2200	2000	3000	3400
425	57,860	55,866	61,233	75,275	65,583	69,470	69,364	63,144	1250	2050	2050	2400
426	51,803	49,057	58,639	66,513	64,729	74,980	51,978	57,762	1800	1900	2350	3150
427	60,585	71,228	72,644	80,274	57,889	60,291	62,107	73,220	2050	3250	2500	3250
428	83,347	44,720	63,687	52,767	58,848	53,016	76,401	69,238	2650	2450	2100	3600
429	70,316	62,498	72,074	40,044	56,181	34,140	58,573	58,563	2000	2000	2400	4250
430	70,939	77,143	57,077	56,460	61,649	34,660	60,633	43,480	4650	2950	3650	2900
431	41,829	28,502	47,489	35,094	80,336	24,786	55,382	43,032	3400	3000	2550	2600
432	51,278	95,948	40,249	41,037	53,631	47,212	65,384	60,932	4000	4100	3050	3100
433	56,556	104,942	65,851	61,209	60,558	55,297	58,305	50,792	3850	3300	3000	3100
434	66,625	94,704	76,567	83,122	71,025	70,266	68,201	70,124	2300	2850	2650	2700
435	94,449	72,579	82,043	76,871	71,414	75,606	70,730	86,267	1850	2450	1900	1900

h (ft)				Hydraulic Depth (ft)										
1988	1994	2004	2013	1915	1948	1963	1975	1988	1994	2004	2013	1915	1948	1963
2800	2900			38.4	34.1	31.3	28.4	25.8	27.1			1,071,922	966,587	840,350
2650	2750	2600	2600	38.1	34.4	33.5	31.3	29.6	31.5	30.6	34.0	1,162,598	1,018,578	940,620
2000	2200	2200	2200	53.7	56.4	42.7	43.0	42.4	42.5	41.4	41.9	1,489,055	1,574,043	1,097,548
2500	2350	2500	2450	46.6	43.8	39.5	32.6	40.0	37.3	34.5	38.0	1,356,154	1,307,453	1,099,546
2150	2100	1900	1950	44.0	47.5	44.9	40.5	41.4	42.7	43.5	45.7	1,181,111	1,431,385	1,164,594
2550	2500	2400	2450	59.8	75.3	59.2	89.0	76.8	48.9	43.9	55.4	2,561,783	4,226,951	1,886,489
2000	2200	2250	2300	53.3	49.2	44.0	38.3	35.8	34.5	35.6	33.8	1,283,008	1,322,722	1,070,444
2250	2350	2400	2350	40.7	42.8	35.5	32.8	33.3	32.5	31.6	30.2	1,059,578	1,202,672	881,800
2100	2050	2100	2050		51.2	44.9	38.0	36.2	34.4	33.4	33.5		1,340,629	1,075,972
2000	2150	2050	2050		54.1	45.7	40.8	37.1	35.0	36.7	37.5		1,430,021	1,140,953
2000	1700	3100	2900		79.7	68.9	70.8	68.9	58.8	37.6	37.3		2,509,599	2,024,014
2600	2650	2500	2550		48.7	30.3	33.9	32.3	29.8	40.6	35.0		1,750,909	767,313
1900	1900	1850	1850		36.1	36.8	38.1	40.0	40.3	42.7	42.0		1,006,084	875,990
1450	1500	1550	1550		50.4	51.5	46.1	51.4	47.1	49.0	50.4		1,308,099	1,141,379
1700	2050	1900	2000		54.7	49.6	42.1	48.3	34.9	40.8	36.9		1,417,117	1,204,925
2100	2250	2250	2350		38.6	40.5	36.0	37.2	32.0	31.2	31.8		1,078,257	857,983
2350	2400	2250	2150		35.9	32.3	27.6	33.5	30.6	40.2	35.5		919,980	869,493
1400	1900	2150	2250		31.3	32.9	23.1	26.7	20.0	24.8	22.9		778,602	693,420
1300	1600	1850	1550		43.1	33.9	25.8	28.6	24.2	25.0	26.7		955,329	673,799
1400	1200	1300	1400		47.2	55.7	67.0	60.3	52.5	55.4	54.5		862,396	1,218,851
1350	1900	1950	2150		40.9	32.0	39.6	38.8	29.0	32.2	28.9		873,966	516,680
2500	2150	2100	2150		25.2	20.5	18.7	15.2	22.6	27.0	25.5		411,360	437,825
2200	1800	2050	2000		19.9	24.7	15.9	16.8	27.0	25.0	27.2		446,463	493,311
1950	1850	1600	1550		23.8	31.7	33.2	43.8	42.5	44.7	47.1		667,782	777,759
1500	1450	1900	1750		45.3	50.3	62.6	58.8	47.6	37.8	41.2		1,238,312	1,369,333
2200	2300	2400	2050	67.3	85.5	50.3	38.9	37.5	30.6	28.0	33.2	1,780,377	4,644,835	1,714,179
2950	2900	2700	2500	44.9	30.5	24.4	21.8	23.4	22.9	24.9	23.9	1,048,624	833,261	603,586
2200	2350	2050	1850	27.9	31.6	32.4	42.1	43.5	46.0	45.7	50.3	1,002,420	931,022	854,580
2450	2250	2400	2100	16.9	26.2	26.1	17.2	22.7	27.7	24.0	25.3	585,073	658,628	596,329
3650	2900	3500	2800	21.7	16.1	18.9	14.7	15.1	18.3	14.7	16.8	608,966	375,834	476,102
3000	3000		3100	35.1	28.4	32.2	24.5	24.6	25.1		25.9	957,834	752,800	930,155
2700	2550		2200	36.2	30.8	26.8	28.1	27.3	38.5		52.2	912,267	833,159	660,342
1950	1750		1650	45.9	37.1	34.6	37.6	45.7	50.7		52.7	1,208,315	949,940	863,957
1450	1750		1750	66.1	55.3	53.4	50.7	47.7	45.7		40.4	1,405,849	1,326,028	1,171,967
1050	2450	2750	2600	44.5	52.5	35.1	32.6	49.7	22.5	19.6	19.7	1,175,242	1,213,606	772,864
3500	4200	4300	4300	12.8	33.0	22.2	25.1	16.8	12.3	13.3	13.2	280,818	1,050,647	559,953
3200	3400	3200	3300	22.9	22.3	20.3	16.8	18.1	17.7	17.8	17.0	701,655	583,528	497,121
2700	2900	2850	2900	35.4	30.4	24.8	22.4	26.0	23.7	23.2	21.6	1,047,339	783,923	581,142
2100	2150	2250	2200	44.7	37.9	36.6	40.3	38.9	36.0	31.6	35.5	1,183,028	1,005,695	865,908
1500	1700	1750	1800	55.4	54.6	51.3	48.1	54.6	46.4	43.9	43.2	1,489,712	1,413,368	1,098,631
1800	2000	2200	2500	51.2	53.7	34.7	41.2	45.4	37.7	31.8	30.0	1,410,791	1,528,099	866,376
2150	2200	2400	2550	53.2	22.1	26.7	22.2	25.7	25.1	26.0	24.4	1,317,445	529,919	476,533
2500	2550	2800	2700	41.9	29.6	22.0	18.6	25.3	20.9	23.3	19.4	732,691	424,059	441,412

2500	3000	3400	3250	21.3	16.0	17.4	16.5	20.0	16.8	16.6	16.7	424,895	436,684	402,662
1900	1900	2000	2050	27.2	30.4	31.8	32.2	34.5	36.5	33.7	31.7	739,605	782,936	732,767
1550	2100	2200	2250	43.1	36.7	32.7	31.3	34.9	29.8	28.5	25.5	980,000	769,661	568,959
2350	2500	2600	2700	40.9	39.0	30.3	23.7	22.9	25.1	21.1	20.7	945,693	873,361	603,242
2450	2600	2600	2500	43.9	37.6	29.0	25.9	26.9	26.8	23.5	23.1	1,120,093	949,961	657,488
1850	1900	1700	1850	50.7	48.5	38.0	37.7	42.4	37.5	40.5	34.7	1,042,549	1,159,736	814,837
1100	1300	1500	1450	50.1	56.4	61.9	57.2	73.5	64.4	49.2	43.1	1,021,247	1,201,912	1,258,639
2450	3100	3000	2750	42.8	53.8	31.7	25.0	33.5	28.1	27.5	29.4	1,154,152	1,225,761	779,518
2000	2100	2000	2000	39.9	33.8	36.6	38.3	47.8	47.0	42.6	42.1	1,209,092	846,020	889,608
1350	1750	1900	1900	44.5	42.1	39.5	40.2	46.7	38.3	35.3	30.8	1,117,454	969,923	800,312
1900	2350	2550	2550	51.8	49.8	47.4	39.9	38.7	37.3	30.3	28.6	1,366,728	1,248,232	1,178,545
2000	2200	2250	2250	52.3	55.5	43.8	39.5	38.1	35.4	33.8	32.2	1,535,115	1,453,067	952,476
1900	1800		1850	43.1	44.4	35.9	37.1	34.2	37.6		36.0	1,033,143	945,090	625,011
2750	3150		2200	22.7	25.9	26.6	19.6	19.3	17.0		22.5	544,081	475,717	520,778
2800	3000		3250	22.0	19.3	20.0	21.6	22.7	18.4		16.8	612,864	492,021	517,397
2200	2650		2800	30.2	28.5	26.8	22.6	27.2	23.6		20.3	909,589	784,206	538,901
2350	2400	2050	2400	36.1	33.2	32.2	26.6	29.3	28.1	30.6	26.7	1,046,691	839,777	732,787
1950	2100	2050	1550	52.9	46.0	40.5	30.8	34.9	34.5	29.5	35.1	1,380,011	1,122,499	812,846
1750	2150	2050	2000	58.8	39.1	27.0	24.0	30.3	30.5	27.4	25.9	1,333,918	877,047	499,032
1350	1550	1850	1800	43.7	36.7	30.9	26.5	45.6	43.3	33.1	29.6	920,055	770,111	502,786
2700	2900	3350	3400	27.7	17.3	17.5	18.9	28.1	23.8	16.5	11.7	648,429	357,801	388,058
1950	2350	2950	3050	26.0	16.8	16.9	18.2	30.5	28.3	19.1	15.8	810,733	336,993	384,812
1700	2000	3550	3650	29.6	18.4	23.5	23.8	28.4	28.1	13.4	10.5	821,640	379,199	415,655
1900	2100	3000	3050	28.0	22.9	22.6	26.1	28.7	28.2	18.3	16.6	749,688	590,157	479,927
1850	2350	2600	2650	35.0	29.0	31.2	29.9	38.7	24.7	24.2	23.9	974,270	752,448	663,123
2500	3400	3650	3350	54.2	44.4	31.2	22.1	26.0	14.1	21.6	22.8	2,174,220	1,111,420	571,738
6150	2550	3350	2250	15.3	15.6	13.6	9.4	7.2	13.4	17.6	17.0	350,108	302,515	291,223
4200	4850	3050	2250	17.0	18.2	11.1	11.5	7.4	11.0	18.5	21.3	518,400	458,631	240,411
1800	2600	2200	1750	19.0	18.0	16.8	13.9	21.6	16.7	25.3	36.8	527,442	407,543	297,383
2450	2800	2400	2250	15.0	23.0	20.9	20.3	25.5	24.5	27.1	29.1	456,450	625,255	435,969
2000	2500	2150	2800	20.2	32.2	41.6	47.3	53.9	34.2	27.0	22.1	917,870	586,486	949,131
2400	2600	2200	2100	30.2	43.2	31.6	21.9	26.9	21.6	23.6	23.3	936,261	1,357,445	961,897
1550	2000	2500	2750	39.7		26.7	21.1	24.8	20.2	18.5	12.5	1,271,748		702,269
3550	3800	3950	3850	53.4		20.1	14.1	12.8	13.1	12.8	11.2	1,626,507		527,014
2350	2750	2950	2850	41.0		26.9	20.5	20.6	20.9	20.3	20.5	1,096,429		640,268
2050	2300	2200	2050	30.2		32.4	29.1	28.1	31.5	29.6	30.4	1,008,247		758,822
1650	1900	1650	1700	42.3		32.5	32.6	37.6	38.1	37.8	38.4	1,489,080		729,734
1600	2100	2050	1700	55.3		38.8	40.9	45.4	40.5	32.3	35.7	1,645,921		934,333
1400	2200	2100	1950	54.2		37.8	46.5	44.6	40.4	30.6	28.7	1,551,590		958,989
3200	2950	2950	3050	40.5		30.2	19.8	16.4	28.6	19.2	17.1	1,670,428		892,201
2450	3400	3600	3600	35.4		19.9	19.9	19.4	21.5	14.8	14.3	898,188		505,990
2600	2950	2900	2900	29.1		23.5	20.1	26.5	28.2	21.2	20.6	838,558		599,681
1800	2200	2150	2150	23.7	24.2	34.3	55.0	56.2	48.8	35.8	34.3	715,278	687,877	976,727
1000	1750	1650	1650	35.3	43.3	50.5	62.2	60.6	53.0	46.2	39.9	1,083,597	1,387,812	1,206,606
1550	1850	1650	1700	49.3	49.4	50.1	51.5	57.1	50.1	40.8	48.2	1,325,697	1,627,946	1,090,066
1800	2550	2500	1900	58.8	60.9	46.9	44.4	56.9	43.3	37.2	43.6	1,421,366	1,741,767	1,280,032
2450	2450	2350	2400	48.1	40.1	34.5	42.0	47.8	47.1	42.0	37.0	1,145,343	1,363,988	948,806

2000	2700	2750	2750	34.2	24.7	27.0	33.1	37.9	33.1	29.2	29.1	1,099,762	640,617	645,788
2150	2600	2700	2700	32.4	26.2	20.8	41.5	35.9	34.4	33.4	33.4	1,251,302	706,318	495,661
1900	2500	2050	2050	62.4	40.1	30.0	27.3	35.5	28.1	35.7	31.5	2,353,149	1,104,331	608,036
1500	2600	2500	2750	28.4	45.6	24.2	20.8	47.3	25.1	29.3	24.7	831,929	1,457,033	424,179
3150	2350	2700	2550	21.6	13.3	26.2	18.6	20.8	26.8	25.7	25.7	653,812	263,437	601,277
2950	3000	3200	3100	30.2	14.4	26.3	23.1	24.5	20.5	19.5	15.5	862,448	319,230	568,946
3350	3450	3400	3050	36.3	25.1	18.7	20.5	25.9	22.6	23.4	21.7	973,056	697,542	394,984
2050	2100	2000	2000	43.7	31.0	33.8	32.8	43.2	37.8	42.2	42.3	1,084,929	671,436	796,736
1750	1650	1750	1550	41.0	35.7	39.4	60.7	49.9	60.1	41.6	55.5	1,220,318	775,674	911,586
1400	1300	1600	1250	47.0	43.5	59.1	70.4	61.7	53.3	54.6	48.3	1,162,969	1,050,067	1,390,473
2250	2300	2200	1650	51.4	40.7	54.7	25.8	36.8	43.3	25.6	37.9	1,030,263	794,274	986,272
3800	3900	3900	4400	46.0	19.8	19.2	18.7	25.2	26.4	18.6	14.2	827,513	457,902	535,299
3000	3450	3650	3400	32.9	24.2	19.0	22.1	28.6	24.0	19.2	15.3	808,766	645,968	471,556
3000	2700	3000	3000	37.2	36.0	24.2	29.9	30.2	32.8	25.2	23.9	1,078,777	863,979	597,299
2200	2250	3000	2200	38.3	27.2	25.2	41.9	43.7	42.2	25.3	36.7	980,963	676,769	618,628
1800	2600	1850	1750	42.7	28.0	29.2	33.1	40.3	29.8	36.7	41.8	1,120,705	684,248	733,304
2000	2350	1550	1500	39.9	31.2	36.5	25.8	28.0	30.0	38.0	40.8	1,003,330	848,605	845,090
3650	2550	2250	1750	32.8	17.9	43.1	19.0	16.9	20.9	23.1	29.6	1,075,860	372,596	794,818
4250	3250	3700	3050	32.2	21.5	30.6	18.7	16.1	12.7	16.7	19.8	963,483	648,195	883,965
3900	3700	4000	3250	39.9	16.9	23.8	20.3	18.7	11.6	16.8	18.5	1,209,878	418,058	609,784
3550	3250	3600	3550	48.0	20.0	27.5	25.8	21.3	13.3	18.7	18.4	1,392,637	535,686	677,214
2950	3150	2500	3100	51.1	37.4	29.0	33.2	28.5	24.9	30.8	22.1	1,267,605	918,306	683,232
2350	2200	2000	2550	35.3	47.0	45.3	46.8	36.5	32.8	35.9	30.5	1,122,130	1,072,074	1,151,628
1750	1950	2050	2050	39.1	51.9	44.3	43.7	55.8	48.3	45.7	56.5	1,059,685	1,261,960	1,027,165
2200	1800	1900	1750	35.9	56.3	40.6	52.3	25.9	41.5	41.1	47.9	1,037,703	1,655,033	1,150,911
2450	1650	1750	1550	36.1	36.2	50.5	42.0	33.4	35.9	39.0	37.8	787,798	712,605	1,347,275
3150	2600	2250	1950	56.0	33.3	38.5	38.4	16.3	21.1	26.0	31.3	1,351,697	688,676	878,836
3050	3000	2650	2750	26.8	37.4	25.1	24.2	23.6	26.6	26.9	22.2	756,043	836,118	657,535
2000	2650	2600	2950	17.5	25.1	19.4	28.4	35.6	24.8	28.6	26.0	464,616	645,299	478,262
2750	2450	1700	2650	19.0	22.9	22.7	30.6	22.9	25.6	27.3	22.5	556,004	506,558	526,498
2750	2650	3050	2950	15.3	20.4	22.7	19.2	21.2	23.4	20.3	18.9	414,968	312,084	528,370
4600	4100	2900	2850	13.1	36.9	20.2	12.5	12.9	10.9	18.4	15.6	387,458	817,211	464,331
4750	3500	3450	3000	16.3	31.4	17.6	13.0	13.7	14.6	16.3	14.1	460,639	826,070	415,061
3750	2400	2950	2650	16.4	27.7	20.3	15.8	17.4	18.7	22.6	21.7	479,495	697,735	461,650
2650	2400	2450	2300	17.8	27.5	26.0	24.1	30.5	32.6	30.7	32.3	478,368	690,350	568,792
2250	1950	1700	1800	16.1	21.8	27.2	30.4	35.4	43.0	40.4	46.2	459,924	552,534	637,716
1700	2000	2400	1850	24.2	32.1	39.8	50.5	43.5	43.5	31.3	42.7	807,209	598,820	1,138,886
5750	4250	2850	3300	10.5	12.3	21.7	16.9	16.4	16.2	34.7	27.6	279,939	241,655	539,494
3800	4000	3500	3750	14.0	9.2	15.7	12.9	19.3	13.1	16.9	11.4	391,561	152,112	389,599
3600	3600	3650	3650	20.0	17.4	16.7	21.2	23.7	21.2	19.2	18.3	568,720	425,146	429,330
3500	3300	3450	3200	27.3	24.3	19.5		25.0	23.2	20.0	21.0	706,371	715,301	503,391
3200	2800	3000	3000	27.7	26.8	22.0		27.7	28.3	24.9	23.5	761,374	790,443	579,579
2800	2850	2600	2700	42.0	34.1	30.1		32.4	31.9	29.8	33.0	1,193,057	951,158	798,877
2350	2300	2350	2350	54.5	36.8	36.7	38.2	35.1	32.3	29.9	31.1	1,372,704	975,254	930,645
3200	3200	3200	3200	52.3	28.5	29.0	34.4	28.4	28.0	23.5	26.1	1,315,074	730,535	863,022
2450	2550	2550	2600	27.7	38.1	37.8	50.2	37.9	37.4	32.2	34.8	711,056	1,034,844	1,022,638
1850	1900	1950	1950	33.7	65.9	57.8	63.3	48.1	44.1	42.0	43.0	789,171	1,504,078	1,382,431

2550	2550	2600	2550	35.6	45.5	44.4	46.3	30.5	31.5	29.5	31.8	945,232	1,044,611	1,084,906
3900	3900	3000	3200	40.6	26.4	27.5	23.1	17.8	16.0	19.3	21.9	1,030,598	536,753	562,829
3550	3600	3150	3250	35.3	15.8	17.0	22.6	22.6	23.1	22.3	24.7	912,255	421,026	405,339
2850	2750	2750	2600	23.5	20.9	24.6	23.7	30.7	35.1	29.9	33.8	635,707	459,225	572,892
1900	1750	1750	1800	24.2	18.0	29.4	35.5	39.3	48.5	43.6	44.3	629,372	476,271	700,500
2050	1950	1700	1750	29.4	22.4	31.3	40.7	35.1	42.0	42.2	40.7	812,183	607,116	654,214
3200	3200	3000	2850	24.7	21.5	26.6	32.4	20.1	24.5	18.4	19.1	690,907	525,401	557,912
3700	3900	3950	4300	32.7	35.9	25.5	26.3	16.6	15.9	10.8	11.5	802,001	664,974	675,326
3150	3150	3350	3300	30.4	26.3	26.8	23.7	20.6	21.0	18.3	17.9	712,369	779,688	552,706
2450	3100	3400	3350	27.7	21.0	24.0	18.7	24.1	16.0	15.5	16.9	444,318	633,584	498,672
2100	2600	3150	2850	11.1	19.6	18.7	22.8	28.3	20.4	16.7	18.4	262,936	342,623	369,602
3200	2400	2550	2400	20.1	29.6	16.6	13.2	17.6	19.1	18.6	24.1	517,947	524,358	387,905
5500	5550	3850	4350	21.2	25.8	16.1	14.0	15.3	11.0	16.4	12.8	552,151	551,671	485,987
4800	3900	3650	3250	22.1	18.3	17.1	15.0	18.1	15.3	16.7	15.6	564,668	437,935	492,127
2850	2600	3000	3000	20.9	19.2	27.6	29.8	29.3	36.3	25.5	24.7	532,241	352,289	707,144
2000	2550	1950	2400	37.5	33.2	35.0	39.8	42.0	36.5	36.0	35.7	965,362	856,708	712,543
2400	2250	2100	1950	42.1	39.6	38.8	48.1	25.5	30.7	29.8	35.3	915,545	735,585	622,833
2750	1750	1800	1800	35.0	22.7	23.7	44.6	27.2	30.5	32.1	32.4	580,368	446,766	545,672
3050	2800	2950	2500	32.6	19.6	21.9	18.6	23.0	19.9	19.3	21.9	533,305	420,598	522,670
3350	3700	3700	3750	22.4	23.0	20.1	21.4	21.5	19.1	17.0	15.8	401,879	520,628	469,257
3250	2850	3300	3350	25.9	24.9	20.5	24.7	21.5	22.9	15.8	18.7	452,347	616,367	490,594
2950	4000	3100	3400	22.4	23.5	13.8	15.6	21.9	13.2	18.7	12.2	568,358	646,225	434,857
4100	3700	3400	3500	66.3	13.8	13.2	15.8	16.3	13.5	19.4	16.5	1,518,662	375,325	423,087
3600	3450	3700	3700	28.3	19.6	16.7	28.1	22.1	24.4	28.5	24.1	658,155	419,070	490,750
2650	2750	2650	2600	47.2	18.9	24.6	25.4	23.2	18.9	24.0	25.5	988,006	348,063	603,856
2500	2800	2500	2400	41.5	19.7	23.4	28.7	26.3	21.5	26.1	26.4	1,195,085	353,155	402,359
3150	2450	2400	2700	35.4	20.0	17.4	18.2	18.5	20.5	20.4	18.1	934,282	404,605	372,608
4000	3500	4350	3150	36.4	17.0	20.2	18.2	16.7	17.8	14.9	19.3	839,124	430,644	477,970
4100	4100	4150	4150	43.2	24.5	19.7	24.4	20.8	18.3	20.2	20.9	717,062	723,191	575,850
2300	2500	2400	2500	24.3	32.0	28.1	43.8	36.5	42.2	38.0	38.8	670,714	852,803	803,909
1350	1500	1650	1600	19.9	38.4	53.9	46.2	53.2	53.3	45.1	57.9	431,430	961,537	1,384,882
3500	1850	1800	1800	30.4	36.1	48.8	39.7	23.6	40.4	44.5	38.5	754,237	906,345	1,239,668
3400	2500	2650	2800	50.7	38.8	39.6	36.0	18.4	30.0	21.8	22.7	1,284,863	733,483	918,524
3600	3550	3250	3500	37.2	22.7	24.7	25.4	17.8	20.8	18.6	18.4	786,523	610,177	721,032
3250	2750	3250	3350	27.4	19.6	28.9	29.3	19.7	25.8	23.0	20.4	509,976	428,865	803,384
4750	2550	2550	3200	34.1	26.7	29.0	20.3	12.9	21.1	20.6	18.5	913,779	644,943	656,663
4050	2500	2750	3450	41.1	22.7	27.5	26.6	14.8	17.8	20.3	16.9	1,028,094	592,043	552,213
4100	3650	3050	3950	49.6	20.5	29.5	21.2	15.1	16.4	18.9	15.2	1,106,661	545,058	690,564
3900	3750	3800	3700	31.1	25.8	24.0	26.3	18.6	29.6	21.7	25.2	770,951	564,702	599,748
3300	2450	2800	2900	27.2	29.7	26.1	24.8	25.5	34.1	27.9	25.5	837,261	710,398	667,905
2600	2200	2750	2500	20.9	22.2	27.6	32.4	35.1	38.0	30.3	36.7	506,515	525,941	642,818
1700	2100	2500	2100	41.3	20.2	23.4	27.1	38.9	31.1	30.2	36.5	862,947	388,871	681,757
3000	1850	2200	2000	27.2	12.4	21.4	21.9	20.5	24.4	22.5	26.3	664,757	284,141	528,444
4050	3750	3850	3850	51.2	13.3	20.9	18.1	19.0	14.7	18.7	17.0	1,163,669	290,380	561,358
4850	5350	4350	3650	40.0	17.2	18.2	19.2	16.8	11.3	14.8	16.0	1,240,924	395,226	613,052
2450	2650	2700	2650	33.2	19.7	26.9	43.5	32.5	30.7	31.3	29.9	704,675	451,810	700,405
1700	1750	1800	1800	22.9	30.9	32.9	38.8	50.4	57.0	45.3	50.0	507,533	729,728	691,369

1650	1350	1450	1300	34.2	39.6	27.5	43.3	47.8	50.1	58.8	53.5	776,428	966,647	699,697
2300	2450	2150	2050	47.2	9.4	31.3	15.8	12.5	22.6	27.5	26.1	1,570,994	64,450	682,121
4600	3850	3550	3250	31.8	23.9	22.1	23.4	19.6	27.9	24.8	27.0	318,960	357,501	520,877
1950	2400	2300	2150	25.8	8.3	26.7	43.0	40.4	31.0	36.2	35.3	381,790	124,526	597,775
1600	1550	1600	1550	23.2	21.4	38.8	39.0	41.7	41.3	42.3	45.1	330,713	436,129	645,597
1750	1900	2000	1600	25.4	32.3	23.4	27.5	30.4	30.7	29.9	29.8	296,153	620,870	486,951
2900	2700	2300	1850	22.5	32.6	21.2	24.9	21.3	27.1	26.6	27.4	232,752	549,587	447,329
2900	2500	3000	3000	21.9	38.1	19.5	31.5	26.7	32.7	23.6	25.1	189,194	776,764	438,425
1700	2300	2050	2150	18.5	27.3	30.0	32.0	37.3	24.8	30.0	25.5	253,015	618,422	535,539
2700	2600	2450	2600	20.6	23.3	24.1	21.3	22.4	15.5	21.4	17.7	271,646	399,838	371,945
3650	3850	3950	3950	17.5	22.9	19.5	19.8	16.8	12.9	17.5	14.5	260,594	368,006	425,419
2750	2800	2800	2700	46.3	27.3	29.9	31.4	23.8	24.8	24.8	23.4	745,914	505,920	589,483
3450	3300	2250	2200	28.8	25.8	25.0	21.1	18.8	22.7	23.1	26.3	486,500	428,551	500,722
3550	3300	3000	2300	29.6	21.9	29.1	24.7	16.3	18.3	20.7	31.8	579,123	557,828	686,610
3900	3100	4350	2600	31.5	18.3	30.3	14.7	15.1	17.1	17.6	26.6	830,453	310,023	619,355
4100	2750	2100	2050	35.2	31.2	30.0	9.4	13.7	12.4	27.9	28.6	754,643	620,045	696,340
3750	3000	2200	2200	15.3	26.2	15.6	19.5	16.4	11.6	27.6	19.8	436,353	679,638	356,927
4950	3900	3500	3550	12.3	9.5	18.6	13.5	16.2	6.4	15.8	12.1	222,916	127,854	333,651
3150	3150	3350	3550	12.8	23.4	13.2	13.2	17.0	15.0	19.5	17.2	280,871	784,999	224,761
3150	2850	3100	2850	14.7	31.8	22.0	19.7	19.2	19.4	18.8	17.8	339,228	1,053,358	516,244
2850	2450	2750	2650	29.0	33.2	28.9	30.8	24.9	28.7	24.8	26.5	628,411	978,848	720,954
1900	2050	1950	2100	51.1	29.6	43.2	40.5	37.6	36.9	36.3	41.1	1,299,822	694,882	1,009,788

Conveyance (AD ^{2/3})					Width/Depth Ratio							
1975	1988	1994	2004	2013	1915	1948	1963	1975	1988	1994	2004	2013
726,490	629,395	711,053			63.8	79.3	86.2	96.9	108.7	106.8		
868,983	752,099	864,174	778,511	926,622	70.9	81.4	80.6	89.5	89.4	87.3	85.0	76.5
1,080,865	1,032,486	1,139,603	1,088,474	1,112,973	36.3	33.7	49.1	47.7	47.1	51.7	53.2	52.5
831,722	1,171,850	980,066	915,546	1,050,187	48.3	54.8	60.8	76.7	62.4	62.9	72.4	64.6
1,025,542	1,064,090	1,096,524	1,021,348	1,140,225	48.8	48.5	45.6	53.1	52.0	49.2	43.7	42.6
4,434,480	3,537,313	1,635,097	1,311,530	1,973,935	46.8	41.8	35.5	28.1	33.2	51.1	54.7	44.2
915,830	776,966	805,936	866,531	813,042	31.9	40.6	44.3	54.8	55.9	63.7	63.2	68.0
773,745	776,875	779,734	757,358	687,980	54.1	53.8	64.8	70.1	67.5	72.2	76.0	77.8
837,379	832,420	745,846	727,443	713,586		37.1	42.4	51.3	58.0	59.6	62.9	61.2
992,307	824,098	805,783	830,182	861,778		34.2	42.6	50.2	54.0	61.4	55.9	54.6
2,120,454	2,318,258	1,511,227	1,307,850	1,209,915		21.3	25.4	24.7	29.0	28.9	82.5	77.7
956,563	852,685	757,090	1,199,948	954,296		55.5	85.7	79.8	80.4	89.1	61.5	72.9
842,312	887,156	901,750	963,687	937,039		70.6	58.4	51.1	47.6	47.1	43.4	44.1
977,386	1,031,549	922,452	1,015,704	1,066,574		37.7	31.1	35.8	28.2	31.8	31.7	30.7
969,015	1,087,210	763,490	919,157	817,851		32.9	36.3	45.1	35.2	58.8	46.6	54.2
765,611	872,216	724,862	696,083	749,429		63.5	44.5	54.2	56.4	70.4	72.1	73.9
643,996	819,542	718,406	1,063,304	826,155		65.4	82.0	92.3	70.1	78.4	55.9	60.5
411,692	334,659	280,258	452,503	415,421		79.8	62.3	95.3	52.4	94.9	86.8	98.3
473,880	347,228	324,986	394,266	368,869		41.7	56.1	81.3	45.5	66.0	74.1	58.1
1,601,147	1,299,759	882,014	1,046,974	1,096,343		29.7	26.9	21.7	23.2	22.9	23.5	25.7
529,569	600,513	520,183	636,654	586,818		44.0	50.0	29.0	34.8	65.5	60.5	74.3
328,078	234,314	387,696	511,649	475,190		75.4	139.0	134.0	164.0	95.2	77.7	84.3
267,577	242,574	438,241	437,365	492,670		153.1	95.0	166.2	130.9	66.6	82.1	73.5
824,265	1,061,095	955,994	901,872	950,798		143.1	77.3	72.2	44.5	43.6	35.8	32.9
1,971,802	1,332,127	908,104	807,418	861,316		47.4	39.8	32.0	25.5	30.4	50.3	42.4
981,460	922,592	688,782	620,145	702,149	23.8	32.8	49.7	56.6	58.7	75.1	85.7	61.8
537,511	563,600	537,204	572,740	497,143	41.2	91.8	121.1	144.2	126.2	126.4	108.5	104.4
1,247,543	1,183,392	1,388,218	1,197,088	1,269,204	139.7	93.4	80.3	58.2	50.6	51.1	44.9	36.8
343,671	446,596	570,704	477,940	457,886	310.4	108.8	99.7	174.5	107.8	81.2	100.2	83.0
327,776	336,839	368,334	310,248	308,631	165.7	226.3	187.8	251.1	241.7	158.5	237.4	166.6
619,184	622,237	645,863		701,729	72.7	100.4	88.4	122.5	122.2	119.5		119.8
726,796	669,825	1,120,211		1,604,284	63.5	89.2	102.6	99.7	98.8	66.2		42.1
969,659	1,138,698	1,216,399		1,221,492	44.6	62.0	67.9	61.2	42.7	34.5		31.3
1,111,990	910,845	1,022,723		831,217	19.7	29.8	29.1	31.5	30.4	38.3		43.4
749,488	705,074	439,618	390,177	372,760	47.1	31.4	58.3	69.0	21.1	108.8	140.7	132.2
442,371	384,299	276,409	321,327	317,296	312.1	94.0	144.3	81.5	208.8	340.6	323.1	325.6
376,269	399,057	409,556	389,676	370,828	166.0	147.9	162.8	201.9	176.9	191.9	179.4	194.1
497,384	614,796	565,670	538,779	486,439	77.8	87.2	110.8	125.2	104.0	122.5	122.7	134.2
995,207	937,695	843,753	709,447	844,797	47.0	62.0	58.8	52.1	54.0	59.7	71.3	61.9
1,016,120	1,178,338	1,019,777	956,019	955,596	33.4	33.0	30.2	33.3	27.5	36.6	39.9	41.7
1,103,838	1,041,614	846,803	703,777	723,265	39.1	37.3	67.8	54.7	39.6	53.1	69.1	83.4
351,770	481,104	472,272	546,101	523,174	32.9	138.2	75.0	89.9	83.7	87.8	92.5	104.5
312,417	544,469	403,566	533,373	379,527	34.6	50.7	115.8	129.3	98.9	122.2	120.0	138.9

298,263	368,669	328,988	367,971	353,873	122.2	268.8	198.4	170.1	124.9	179.1	204.6	194.9
698,959	695,042	761,735	702,318	650,629	110.2	87.3	72.4	66.9	55.1	52.1	59.4	64.7
528,459	578,080	602,079	584,598	497,251	42.9	51.8	52.0	54.3	44.4	70.4	77.2	88.2
467,717	434,916	537,209	419,652	422,796	47.7	50.0	67.7	101.5	102.5	99.7	123.1	130.2
565,933	590,904	622,745	501,461	469,129	46.7	59.8	82.7	96.6	91.1	97.1	110.6	108.1
804,692	954,810	796,859	811,632	683,175	29.6	37.1	50.0	50.4	43.6	50.7	42.0	53.3
1,102,859	1,419,943	1,345,311	990,625	767,993	29.9	25.7	21.0	22.7	15.0	20.2	30.5	33.6
608,738	853,350	806,884	749,660	768,909	51.3	29.8	77.2	114.0	73.1	110.2	109.3	93.6
981,058	1,260,882	1,283,934	1,038,212	1,017,081	65.2	71.1	60.0	58.7	41.8	44.7	47.0	47.6
778,131	818,520	761,591	721,609	576,519	44.9	45.1	44.4	41.1	28.9	45.7	53.8	61.6
980,278	839,480	979,838	750,958	682,367	36.7	37.1	40.1	52.6	49.2	63.0	84.2	89.1
937,621	862,381	840,658	795,893	734,606	40.2	32.4	40.0	52.0	52.5	62.1	66.5	69.8
700,950	685,986	758,295		727,567	45.2	38.3	44.6	45.8	55.5	47.9		51.3
383,651	382,079	354,978		395,045	132.4	81.1	82.8	138.0	142.4	185.0		97.7
443,110	510,329	385,868		357,505	161.4	184.2	174.7	122.8	123.2	162.8		193.7
407,150	540,472	514,448		424,446	102.5	103.5	84.1	99.5	80.9	112.3		137.6
546,445	652,875	622,958	612,930	572,174	73.3	73.8	69.9	86.3	80.3	85.4	67.0	89.9
605,926	727,163	767,901	576,866	583,554	35.0	41.3	41.9	64.9	55.9	60.9	69.5	44.1
430,278	514,149	638,467	511,426	452,423	25.5	49.9	75.8	89.5	57.8	70.6	74.7	77.3
364,564	784,966	828,990	630,975	508,575	38.9	51.8	53.4	58.5	29.6	35.8	55.9	60.9
367,968	699,450	569,511	358,456	206,297	91.9	179.5	188.9	145.7	96.2	122.0	203.0	289.5
359,443	579,333	616,906	402,418	302,690	136.5	181.3	203.9	156.4	64.0	83.1	154.5	193.3
413,599	450,445	520,869	269,805	184,646	98.0	160.1	91.3	88.2	59.8	71.1	264.1	346.6
469,412	510,806	548,765	382,378	329,579	103.5	139.8	117.1	78.7	66.2	74.5	163.6	183.7
518,996	818,763	492,978	527,791	526,982	74.3	94.9	69.0	60.2	47.8	95.1	107.3	110.7
452,937	571,688	278,707	609,473	612,577	51.7	45.1	59.3	117.6	96.0	241.7	169.3	147.2
136,178	164,305	192,965	398,535	252,292	241.3	198.5	275.4	345.6	856.7	190.2	190.5	132.5
229,399	118,369	263,345	393,414	368,695	270.2	200.8	391.8	338.3	566.6	441.4	165.2	105.6
289,795	301,255	284,755	480,092	712,828	205.3	183.5	160.8	258.7	83.4	155.3	86.9	47.5
504,586	539,497	578,754	586,816	620,866	333.2	145.4	131.6	165.3	96.3	114.3	88.6	77.2
1,546,102	1,536,143	899,973	521,536	488,325	305.2	55.9	45.7	52.9	37.1	73.1	79.7	126.5
574,337	578,596	435,480	426,478	398,579	106.0	59.0	96.6	153.0	89.3	120.4	93.3	90.2
395,618	327,967	300,183	322,266	184,171	69.2		110.6	116.0	62.4	98.9	135.4	220.7
297,247	248,831	277,230	276,582	214,378	40.3		176.7	254.8	277.2	289.7	308.6	345.2
421,541	362,785	437,145	445,082	436,537	54.9		98.5	134.3	114.3	131.4	145.4	139.2
606,333	532,749	724,455	624,830	608,360	114.4		70.9	75.6	72.9	72.9	74.2	67.3
698,953	697,052	821,201	702,189	742,967	68.6		67.6	64.4	43.9	49.8	43.7	44.3
897,303	924,074	1,001,286	670,536	657,705	37.1		54.1	45.3	35.3	51.9	63.5	47.6
930,612	785,594	1,044,790	629,781	524,431	36.9		59.5	33.4	31.4	54.5	68.6	68.0
470,376	338,545	790,447	407,361	345,058	86.5		101.1	164.3	195.2	103.0	153.4	178.7
336,127	344,538	564,739	320,293	303,619	66.3		173.0	115.6	126.0	158.2	243.6	251.6
431,686	612,166	771,465	470,724	449,216	104.9		131.7	144.1	98.1	104.6	136.8	140.7
1,788,561	1,486,360	1,435,685	837,465	777,749	153.8	140.6	78.8	40.9	32.0	45.0	60.0	62.7
1,609,659	936,065	1,310,382	982,548	769,400	80.7	60.1	34.7	26.5	16.5	33.0	35.7	41.3
1,352,376	1,312,654	1,260,923	796,624	1,084,765	40.6	49.6	31.9	36.9	27.1	36.9	40.5	35.3
1,363,312	1,516,144	1,362,860	1,037,013	1,024,488	27.2	30.4	44.8	55.2	31.6	58.9	67.2	43.6
1,343,137	1,540,933	1,505,574	1,192,434	986,974	37.4	72.3	75.4	63.1	51.3	52.0	56.0	64.8

954,490	853,695	922,252	761,519	757,400	89.1	123.3	98.0	84.6	52.8	81.5	94.2	94.5
1,192,699	838,421	947,414	934,077	932,984	117.3	116.3	151.4	57.9	60.0	75.5	80.9	81.0
655,864	727,249	649,024	793,335	642,447	38.5	58.6	70.0	97.1	53.6	89.0	57.4	65.2
425,723	926,371	557,899	695,482	574,551	111.0	54.8	86.9	129.6	31.7	103.8	85.4	111.5
347,387	495,111	562,791	602,970	570,519	180.5	267.9	99.2	142.1	151.5	87.8	105.2	99.2
459,387	610,580	460,385	452,478	297,944	97.8	260.6	93.2	106.0	120.3	146.4	164.0	200.3
523,671	758,352	621,456	652,073	514,967	67.6	129.7	160.5	165.6	129.5	152.9	145.1	140.5
824,189	1,090,862	894,247	1,023,974	1,025,916	45.8	71.1	66.5	74.7	47.4	55.5	47.4	47.3
1,639,244	1,182,459	1,521,423	875,337	1,253,470	60.9	56.0	50.8	28.8	35.1	27.5	42.0	27.9
1,441,830	1,348,686	980,925	1,257,662	799,500	40.4	44.8	26.2	17.0	22.7	24.4	29.3	25.9
552,040	916,393	1,228,616	490,117	705,847	28.2	40.6	22.8	94.9	61.1	53.1	85.8	43.5
713,703	825,140	914,096	510,330	365,315	30.4	158.8	203.5	288.2	150.6	147.6	209.4	310.4
702,432	803,791	687,184	504,251	321,745	73.1	132.5	184.7	183.6	104.8	144.0	189.7	221.7
894,864	879,080	905,755	651,078	594,386	69.9	61.1	121.9	103.5	99.3	82.4	118.9	125.6
1,189,446	1,191,524	1,150,572	655,385	892,878	58.7	101.1	113.0	56.0	50.4	53.3	118.4	59.9
887,974	851,632	745,428	751,018	882,241	50.4	94.6	90.8	78.5	44.7	87.2	50.4	41.8
640,703	516,360	680,640	664,426	726,206	53.8	88.2	57.5	110.6	71.4	78.3	40.8	36.7
515,847	405,161	403,028	422,859	494,718	97.5	170.7	34.8	199.6	216.3	122.3	97.2	59.2
566,636	437,044	225,249	401,987	441,745	91.5	181.4	96.4	229.9	263.7	255.5	222.1	154.1
544,009	514,131	220,085	440,242	419,277	65.2	221.7	130.3	177.3	208.5	318.8	238.3	176.0
732,622	581,887	243,374	474,908	453,920	45.9	182.9	98.1	125.9	166.5	243.9	192.4	193.3
1,064,879	783,269	668,367	755,989	540,421	35.2	58.9	86.3	93.3	103.6	126.6	81.2	140.1
1,365,580	943,745	740,918	783,143	760,729	83.5	37.2	44.1	48.1	64.4	67.0	55.6	83.5
1,218,255	1,424,729	1,250,237	1,199,284	1,705,931	60.1	33.7	41.7	51.5	31.4	40.4	44.8	36.3
1,828,711	497,922	894,717	928,147	1,104,921	73.7	35.5	59.1	47.8	85.0	43.4	46.3	36.5
1,038,588	847,714	645,502	785,504	660,402	55.4	49.7	38.6	48.9	73.4	45.9	44.9	41.0
1,091,938	330,579	419,237	514,361	606,779	29.5	60.1	51.9	65.1	193.1	123.2	86.4	62.3
679,612	593,311	712,947	641,404	481,419	117.5	53.5	121.4	138.3	129.1	112.6	98.4	124.0
609,115	770,979	559,842	696,921	673,919	226.1	119.5	174.8	80.9	56.2	106.7	90.8	113.4
567,612	508,277	545,500	420,232	475,166	215.5	120.3	127.9	62.2	120.0	95.6	62.3	117.8
413,534	447,433	508,397	461,068	393,908	287.6	100.5	127.7	156.1	129.6	113.1	150.2	156.5
251,082	326,838	219,665	371,369	278,763	409.7	54.2	153.5	301.0	356.3	376.2	157.7	182.2
286,004	373,022	305,040	362,406	246,631	270.1	84.5	199.4	308.7	346.5	239.8	211.3	212.9
368,148	436,278	316,358	532,655	447,487	278.2	99.2	150.1	234.2	216.1	128.3	130.6	122.1
584,288	788,031	799,825	735,934	753,742	222.2	99.9	96.3	120.2	86.9	73.5	79.9	71.2
665,613	858,038	1,028,137	810,015	1,072,360	280.2	149.1	95.8	74.1	63.6	45.4	42.0	38.9
1,240,114	914,372	1,074,378	746,333	965,453	165.6	57.7	61.5	35.7	39.1	46.0	76.7	43.3
441,735	607,841	440,280	1,051,984	834,205	528.0	301.4	147.6	233.1	350.9	262.5	82.1	119.4
350,099	528,405	291,807	389,423	217,065	342.2	406.6	251.3	384.5	196.7	305.0	207.1	328.5
635,633	703,651	585,530	504,072	464,988	192.2	210.2	237.1	183.6	151.9	169.7	189.7	199.2
	749,564	620,739	508,675	512,010	104.3	143.8	181.6		139.8	142.5	172.4	152.3
	812,153	734,929	636,453	576,703	108.3	123.3	152.1		115.5	99.0	120.5	127.9
	922,299	914,650	743,656	914,378	55.9	77.7	91.5		86.4	89.3	87.3	81.9
1,059,543	883,969	754,692	676,825	721,322	32.1	65.3	62.7	64.2	67.0	71.1	78.6	75.7
1,165,254	848,229	827,046	617,533	736,506	34.4	96.5	108.6	93.0	112.5	114.2	136.1	122.4
1,570,733	1,046,001	1,065,627	830,727	964,971	101.0	63.0	63.5	45.8	64.7	68.2	79.2	74.7
1,758,922	1,175,229	1,046,333	987,794	1,031,054	66.9	21.3	27.7	27.7	38.5	43.1	46.5	45.3

1,371,260	760,336	802,374	731,033	813,659	68.8	39.5	43.9	49.7	83.5	80.9	88.2	80.2
638,725	474,914	395,427	417,658	548,227	53.0	87.3	81.9	147.0	218.6	244.0	155.2	146.2
648,228	639,224	673,463	557,729	678,547	68.0	269.7	211.5	159.6	157.4	156.0	141.1	131.8
653,839	856,418	1,034,846	790,567	919,785	140.5	138.9	111.7	141.5	92.9	78.3	92.1	76.9
880,167	862,308	1,130,605	946,832	997,684	127.9	213.8	85.0	64.9	48.4	36.0	40.1	40.6
1,033,269	772,757	987,840	870,191	842,858	98.6	151.5	67.0	52.9	58.3	46.5	40.3	43.0
972,473	476,869	659,609	383,518	387,792	133.7	146.2	88.3	91.0	158.9	130.8	163.4	149.5
733,786	398,992	393,281	208,631	251,618	73.4	47.3	119.4	119.7	223.1	244.8	365.5	374.2
655,825	485,785	505,260	424,370	403,204	78.8	127.3	85.8	141.3	153.3	149.7	183.4	184.6
389,678	491,678	313,366	328,088	371,302	63.1	187.7	104.2	157.5	101.8	194.3	219.2	198.7
385,381	553,479	397,157	343,686	366,514	427.4	122.3	149.6	92.0	74.1	127.2	188.6	154.6
258,309	379,728	326,777	332,547	481,329	174.6	62.5	217.2	265.0	182.2	125.8	137.2	99.7
396,254	520,126	300,280	405,579	304,316	160.4	95.0	295.6	351.2	358.9	506.2	235.4	340.1
408,370	601,163	368,993	399,037	318,175	147.2	188.7	254.9	301.0	264.6	254.4	218.3	207.7
830,319	792,899	1,035,565	663,151	626,470	160.1	132.5	101.3	97.3	97.3	71.6	117.6	121.7
1,044,707	1,016,805	1,025,189	765,009	928,579	61.4	75.3	54.2	56.5	47.6	69.8	54.2	67.2
826,773	528,915	678,862	601,292	741,202	42.8	40.4	36.1	27.0	94.3	73.2	70.5	55.2
925,065	677,713	521,487	582,202	593,122	44.3	107.8	118.4	37.0	101.0	57.3	56.2	55.5
422,838	569,214	408,403	408,690	429,839	49.0	150.5	139.3	175.1	132.3	140.9	153.1	114.0
469,303	554,872	504,898	414,827	373,706	100.2	121.8	156.5	133.3	156.2	193.7	218.0	237.1
544,992	541,629	525,154	328,006	442,701	77.3	116.4	156.2	105.2	150.9	124.6	209.0	178.8
239,759	504,284	295,792	409,618	218,347	143.0	142.5	393.8	156.6	134.9	302.5	165.5	279.8
535,657	431,060	284,700	475,983	375,729	21.1	345.2	436.1	342.4	251.0	273.2	175.3	211.6
712,696	624,967	709,365	982,111	743,421	88.2	150.8	269.5	98.0	163.1	141.3	130.0	153.6
759,568	498,869	368,104	529,090	576,118	33.9	137.7	117.8	135.6	114.4	145.7	110.4	101.8
700,387	582,335	464,870	575,633	561,544	57.8	124.1	89.7	90.5	95.0	130.3	95.6	90.9
427,520	407,309	376,431	365,028	336,567	69.2	137.6	184.3	187.0	170.4	119.5	117.7	149.3
661,908	435,351	424,042	391,574	438,704	57.7	227.1	158.7	288.3	239.9	196.8	292.3	162.9
758,612	643,321	520,799	621,077	656,987	31.3	142.9	202.8	151.7	197.4	224.1	205.6	198.8
1,415,952	924,381	1,276,786	1,032,944	1,109,708	136.1	82.9	110.4	59.3	63.0	59.3	63.1	64.5
1,219,995	1,016,940	1,133,294	943,124	1,386,996	148.2	57.3	33.4	44.4	25.4	28.1	36.6	27.6
1,087,018	680,130	880,248	1,004,063	791,386	83.9	63.7	38.9	59.2	148.2	45.8	40.5	46.7
1,099,408	435,198	722,281	451,229	509,648	36.5	42.5	50.6	77.8	185.0	83.5	121.5	123.3
680,142	438,459	557,912	423,570	447,765	51.1	147.5	139.9	122.1	201.8	170.8	174.9	190.5
808,880	468,726	620,230	604,100	509,856	74.9	152.8	102.0	98.9	164.6	106.5	141.4	164.3
483,256	337,026	411,843	393,679	415,026	74.8	101.0	82.8	157.7	368.2	120.7	124.0	172.7
508,449	362,724	302,022	416,342	384,051	51.1	143.1	79.9	80.9	273.0	140.8	135.3	204.1
512,475	379,801	388,301	408,089	367,322	33.2	173.2	83.0	148.4	270.8	221.9	161.6	260.3
883,084	508,141	1,061,278	639,965	800,202	80.3	96.7	124.9	144.6	209.9	126.8	175.4	147.0
707,883	726,743	879,264	717,780	641,338	124.9	84.3	110.9	134.9	129.7	71.8	100.4	113.7
905,391	979,511	943,671	808,752	1,014,963	153.3	135.2	92.4	84.9	74.0	57.9	90.8	68.1
637,241	759,005	646,248	731,604	844,916	42.4	128.8	151.4	95.8	43.7	67.5	82.8	57.5
384,682	460,059	380,737	394,776	463,899	99.2	347.9	149.4	102.9	146.5	75.7	97.7	76.2
448,714	548,197	329,537	508,615	432,726	32.2	293.7	170.1	199.0	213.1	255.7	205.5	226.5
679,306	532,035	305,697	388,474	370,129	66.2	200.6	265.9	258.3	289.5	472.3	293.7	228.4
1,154,752	812,277	799,283	838,843	761,669	61.7	160.1	107.8	49.5	75.3	86.2	86.3	88.7
823,029	1,168,808	1,477,584	1,035,704	1,220,002	120.1	77.7	62.4	47.7	33.7	30.7	39.7	36.0

799,354	1,038,833	919,186	1,288,561	988,114	62.8	53.0	102.0	34.7	34.5	26.9	24.7	24.3
267,271	154,343	443,300	539,983	471,825	54.0	165.6	70.4	171.4	184.4	108.3	78.1	78.4
623,932	656,265	989,749	749,744	791,721	31.5	75.2	135.9	138.7	234.5	137.9	143.0	120.2
1,029,388	928,733	734,520	913,011	817,992	66.0	439.0	93.5	45.3	48.2	77.4	63.5	60.8
561,753	803,105	763,791	823,112	884,528	75.4	124.0	37.3	32.0	38.3	37.6	37.8	34.4
462,601	519,148	571,278	577,442	458,218	53.2	58.9	109.1	67.4	57.5	61.9	66.8	53.7
649,310	474,149	661,795	546,679	462,076	57.8	50.6	129.6	122.3	136.2	99.5	86.3	67.4
1,003,100	692,342	836,759	583,252	644,267	50.1	47.2	158.9	101.7	108.6	76.4	127.0	119.7
677,194	708,897	483,615	592,434	476,185	105.2	91.6	61.7	65.6	45.5	92.9	68.4	84.2
376,814	481,528	250,904	402,891	311,871	84.8	90.0	76.8	107.9	120.4	167.6	114.7	147.1
491,332	402,550	272,070	468,099	341,987	125.4	87.5	153.5	172.0	217.2	299.2	225.1	271.7
748,649	543,376	590,960	589,458	516,392	27.0	75.2	68.6	76.5	115.3	112.9	113.0	115.5
508,121	457,040	601,496	421,613	510,255	62.5	73.6	94.2	149.2	183.9	145.2	97.4	83.8
680,820	372,253	418,231	468,264	735,471	69.4	148.3	86.0	131.6	217.7	180.6	144.9	72.2
316,033	359,346	351,911	516,228	617,430	84.3	134.2	69.2	245.6	258.5	181.3	247.7	97.6
178,639	321,703	183,040	538,711	547,273	56.9	64.0	79.9	451.1	299.2	221.5	75.3	71.8
408,600	398,586	177,134	553,216	317,837	304.8	112.8	233.4	149.0	228.1	259.7	79.8	111.3
198,948	514,967	85,043	349,060	227,073	276.4	315.8	136.9	192.6	305.0	613.6	221.2	292.9
229,646	354,942	287,002	473,971	405,442	312.0	175.2	231.1	234.2	185.0	210.2	171.6	206.8
447,154	434,587	399,280	412,356	346,545	262.1	103.8	136.7	157.0	163.9	146.9	164.8	159.9
816,495	605,972	658,362	580,006	622,696	79.4	85.8	91.7	87.7	114.4	85.4	110.9	100.1
905,954	801,306	837,702	775,030	1,027,063	36.2	82.7	44.0	47.0	50.6	55.6	53.8	51.1

Summary for cross sections at Bankfull Reference (LWRP+25)

RM	Cross sectional area (ft2)								Width			
	1915	1948	1963	1975	1988	1994	2004	2013	1915	1948	1963	1975
230	155,388	164,871	158,810	153,634	142,147	157,910			2450	3000	3100	3150
231	170,255	168,949	162,752	162,288	144,785	159,892	149,410	158,154	2700	2950	3000	3250
232	153,405	161,330	146,921	146,816	134,868	153,010	150,507	152,056	1950	2350	2350	2400
233	161,025	171,012	159,390	148,397	162,615	153,228	153,128	158,868	2250	2750	2650	2750
234	148,450	170,430	150,034	146,155	142,703	147,935	137,479	143,900	2150	2500	2450	2550
235	237,490	321,051	186,396	289,187	259,553	193,763	173,405	203,829	2800	3400	2900	2750
236	133,098	150,193	138,871	137,355	121,557	134,851	142,830	139,847	1700	2100	2350	2450
237	144,547	160,251	144,137	139,784	131,254	142,571	140,929	136,581	2200	2550	2650	2850
238		150,607	137,330	132,503	128,549	128,683	128,278	126,992		2250	2200	2600
239		155,746	145,965	139,734	124,131	135,324	133,994	135,841		2400	2350	2500
240		188,145	175,693	176,932	187,882	152,188	203,162	203,036		2450	2700	2450
241		215,105	144,848	164,976	149,035	152,526	175,624	164,433		3550	2650	3000
242		171,752	133,940	132,248	123,410	133,910	131,904	130,441		3600	2200	2500
243		161,936	125,166	122,817	110,833	114,716	122,236	124,425		3350	1750	2000
244		168,925	150,433	140,238	124,529	129,666	138,531	135,049		3600	2650	2750
245		161,645	143,084	130,187	130,710	136,687	139,261	143,124		2850	3050	2800
246		151,075	167,411	142,290	137,558	143,896	160,262	148,333		2800	3500	3050
247		147,241	120,282	111,873	72,429	97,129	117,031	115,022		3150	2150	2550
248		128,126	122,357	115,610	69,649	91,765	103,657	97,893		2150	2350	2550
249		105,070	132,967	139,820	119,483	99,678	109,145	114,977		1700	2500	2300
250		130,625	133,724	105,460	86,140	120,762	130,773	131,088		2850	3800	3650
251		110,311	135,467	119,352	100,611	124,331	129,547	129,006		3100	3150	3050
252		143,450	130,786	135,350	91,972	128,983	126,998	132,969		3500	3500	4650
253		200,689	162,251	161,524	134,152	152,054	139,198	139,954		5500	4050	4600
254		158,362	157,004		125,638	119,647	144,471	143,694		2650	2300	
255	147,635	324,022	198,624	150,215	137,409	138,688	145,231	141,901	1600	3900	3150	3250
256	129,281	170,019	151,614	155,126	142,696	157,806	151,812	143,122	1850	3750	3400	3900
257	206,407	183,165	167,652	185,285	150,686	190,404	171,942	173,428	3900	4000	3900	4100
258	220,045	172,209	163,976	142,449	116,919	149,119	158,651	153,908	5250	4350	4500	4150
259	168,213	156,316	159,034	151,903	146,378	152,139	152,574	145,094	3600	4050	3800	3950
260	153,161	157,212	170,579	152,898	148,658	153,862		160,967	2550	3150	3250	3250
261	140,823	157,295	146,735	153,261	141,311	171,984		183,401	2300	3000	2950	3050
262	145,441	148,144	143,801	148,840	137,846	142,331		136,527	2050	2600	2600	2600
263	118,469	135,506	125,864	126,100	105,467	127,580		120,250	1300	1850	1800	1850
264	146,033	143,884	129,959	139,766	78,419	128,286	128,914	125,833	2100	2800	2600	2950
265	151,272	197,854	170,524	154,498	146,172	163,368	170,418	169,296	4000	4200	4150	4350
266	182,014	158,969	154,941	148,337	137,900	152,771	148,790	147,925	3800	3450	3800	3800
267	165,977	153,286	141,905	139,639	137,611	149,349	145,362	142,438	2750	3250	3050	3250
268	146,404	151,409	138,209	143,516	134,182	137,682	131,622	139,055	2100	2650	2500	2700
269	148,751	150,838	127,231	123,749	119,384	126,394	125,629	127,779	1850	2400	2300	2200
270	152,350	162,850	146,480	162,742	126,796	139,313	138,521	143,794	2000	2400	2750	2950
271	136,872	159,331	137,006	121,435	108,998	130,677	141,810	142,564	1750	3850	4550	4700
272	96,993	147,269	163,843	117,368	125,706	129,493	149,703	136,808	1450	4850	5300	3750

273	120,330	183,257	173,752	157,535	112,522	161,029	167,040	163,104	2600	4650	4750	4800
274	156,705	151,928	136,064	128,860	113,070	126,132	125,325	123,573	3000	3000	2950	2800
275	125,977	124,656	109,223	106,677	92,866	121,107	123,555	118,653	1850	2500	2450	2300
276	128,451	136,518	123,891	121,732	112,635	130,129	126,926	129,239	1950	2650	2600	2700
277	141,252	145,529	133,844	132,530	127,103	138,684	132,397	128,544	2050	2500	2650	2800
278	113,584	140,519	127,278	124,924	124,741	125,199	123,219	119,653	1500	2350	2350	2400
279	112,648	130,208	129,421	130,745	108,395	134,158	130,611	117,912	1500	2650	2600	2750
280	149,260	154,824	160,088	153,308	143,350	172,928	175,408	170,747	2200	3300	3500	3600
281	168,625	151,645	149,594	151,305	145,679	157,931	146,525	146,141	2600	3100	3350	3350
282	138,992	138,108	125,376	118,573	96,839	118,919	121,004	112,278	2000	3050	3600	2400
283	145,881	147,655	147,124	143,508	120,936	151,205	146,654	145,466	1900	2700	2550	2600
284	162,292	152,988	129,966	139,515	126,178	137,493	136,889	133,556	2100	2300	2550	2950
285	132,795	134,534	116,516	119,723	112,556	120,377		122,012	1950	2850	3150	3250
286	142,959	137,810	153,440	144,428	121,841	147,475		138,629	3000	4050	4450	4350
287	166,825	165,868	164,005	145,439	133,617	141,764		142,407	3550	4000	3900	4100
288	171,224	165,329	141,871	117,409	114,791	136,395		132,875	3100	3500	3700	3450
289	162,011	151,450	141,341	125,334	127,508	135,079	126,392	129,697	2650	3350	3750	3250
290	144,154	143,186	120,695	117,351	116,826	129,804	116,561	110,310	1850	2600	2900	2300
291	125,709	144,055	125,724	121,502	96,700	130,747	121,191	118,158	1500	3100	3250	3350
292	116,711	136,863	137,564	113,470	95,274	135,096	139,965	132,109	1700	3400	4100	4350
293	134,501	150,240	158,591	145,507	143,253	157,270	146,170	131,087	2550	4150	4250	4400
294	181,096	131,805	148,972	144,404	108,148	137,574	136,670	130,156	3550	3300	3650	3950
295	158,356	135,371	128,267	122,972	90,846	129,053	140,039	135,075	2900	3350	3400	3750
296	153,762	161,194	142,374	119,478	102,007	129,402	135,423	131,340	2900	3600	3650	3550
297	156,033	152,008	131,012	112,063	117,825	122,759	132,667	134,415	2600	2950	2850	2700
298	221,791	147,002	116,839	128,524	127,584	149,721	200,753	188,772	2800	2500	2500	2950
299	185,432	173,421	177,404	177,704	197,901	170,451	197,680	170,582	5150	5850	5950	6450
300	193,325	175,474	160,954	162,864	136,134	196,111	177,986	142,087	4600	4700	4600	4900
301	171,585	157,992	133,500	144,346	83,857	141,195	138,095	135,397	3900	4350	3850	4000
302	209,915	187,570	136,137	156,397	123,603	150,584	133,676	133,086	5400	5000	4000	3650
303	287,325	154,029	149,945	196,594	157,714	163,026	138,773	143,986	6550	6850	3850	3500
304	177,858	238,950	202,293	170,408	124,493	155,937	145,136	136,918	3250	7400	5850	5100
305	177,988		188,105	148,805	77,265	153,847	151,614	141,188	2750		5100	4550
306	168,494		164,012	146,043	134,211	148,710	156,102	142,824	2150		3750	3900
307	152,232		150,766	138,271	107,080	143,547	144,552	141,372	2400		4000	4150
308	192,740		148,960	132,356	108,876	137,463	128,619	126,174	3550		4000	3850
309	195,162		147,209	125,181	103,330	126,103	112,167	115,345	2900		3500	2350
310	165,902		151,011	136,829	112,623	144,931	130,987	117,914	2100		3200	3250
311	159,634		149,339	126,552	97,455	155,331	131,417	123,796	2050		2700	2700
312	246,091		172,776	149,252	132,460	173,944	142,237	139,788	4200		3350	3450
313	144,506		158,603	146,249	108,894	171,047	154,151	155,065	2450		3750	4400
314	171,787		154,924	146,095	133,883	166,618	140,377	142,225	3350		3500	4150
315	179,094	173,168	171,427	190,600	146,247	182,590	138,279	135,337	3700	3700	3850	3600
316	171,910	186,958	141,356	150,626	85,643	141,761	124,039	114,222	2850	3250	3200	2300
317	148,600	191,896	140,431	162,068	127,266	155,867	132,734	142,845	2000	3300	3150	3250
318	143,318	167,249	165,867	176,207	147,460	183,093	167,624	154,521	2000	2500	2950	2850
319	145,576	201,585	176,213	197,356	178,291	191,302	167,828	158,439	2400	3850	4200	4400

320	181,810	169,505	149,571	174,830	125,717	163,405	156,182	155,097	3100	4150	4000	4550
321	218,121	177,461	159,573	177,975	130,850	164,400	164,723	163,081	3800	4850	4300	3950
322	215,740	202,042	162,166	154,099	114,877	150,836	142,708	136,092	2650	5050	4900	3700
323	168,158	218,583	139,395	148,280	108,377	161,172	161,029	158,390	3150	4450	4350	4250
324	181,775	160,387	157,659	137,840	162,818	148,749	161,086	164,167	3900	4700	4450	4250
325	162,746	150,124	153,511	127,344	187,875	173,684	181,198	165,614	2950	3900	4450	2850
326	152,444	168,576	137,180	156,008	178,759	167,949	169,510	151,374	2550	3550	3350	3450
327	147,658	134,751	136,133	145,133	147,878	136,302	140,754	138,798	2500	3350	2450	2600
328	168,454	131,890	138,302	156,472	137,480	146,706	124,345	136,652	2650	2950	2750	2050
329	139,211	140,463	137,419	118,410	156,524	134,284	158,396	131,954	2000	2500	2000	1350
330	118,915	140,047	152,877	155,734	192,199	196,807	157,979	167,150	1850	5400	4600	3800
331	163,639	178,704	202,187	240,563	218,677	227,177	176,313	174,422	4650	5700	5300	5600
332	174,958	177,733	155,579	193,007	174,285	175,757	168,091	148,579	4150	4450	3600	4150
333	161,772	166,056	147,250	180,189	171,697	165,191	154,108	150,940	2600	4200	3050	3550
334	147,181	157,234	153,143	162,562	158,702	156,722	154,423	145,285	2450	3600	3350	2550
335	155,927	149,078	147,740	156,650	142,856	152,750	139,904	139,794	2650	3150	2850	2850
336	147,430	159,594	142,416	147,166	147,399	154,935	133,192	136,889	2500	3100	2950	2950
337	184,982	138,254	140,491	168,565	176,717	149,174	149,732	145,415	3200	3500	3450	3850
338	168,862	187,023	197,810	191,135	180,398	144,798	172,427	164,469	2950	4250	4450	4450
339	174,458	164,146	164,229	166,795	174,668	143,148	172,128	158,440	2850	4150	3800	3750
340	165,938	172,167	150,416	166,604	168,914	134,050	161,002	158,034	2450	4100	3100	3300
341	166,942	160,816	140,278	180,521	169,807	162,928	155,081	151,804	3200	4400	2800	3100
342	181,377	132,593	143,669	162,617	151,183	138,637	137,073	144,514	3100	2150	2150	2300
343	156,623	138,758	133,144	157,755	152,351	146,552	148,945	170,939	2600	2050	2150	2350
344	164,949	166,678	161,654	199,793	125,830	127,815	130,525	131,658	2800	2250	2650	2800
345	158,740	121,731	151,512	140,811	161,058	132,593	132,642	126,241	3850	2650	2150	2200
346	137,155	150,467	139,634	163,137	138,984	133,230	145,474	144,503	1800	4700	2700	2700
347	173,937	166,542	166,483	173,432	163,690	177,105	177,039	165,631	3700	5300	3900	3700
348	176,991	200,797	159,812	132,866	165,445	174,867	165,135	164,742	4350	7300	3850	2700
349	180,512	153,884	155,956	107,976	154,499	144,240	137,022	155,888	4100	5150	3700	2000
350	201,027	115,213	166,125	134,901	172,457	164,205	156,887	154,477	5450	4600	4500	3100
351	229,069	153,345	167,809	146,309	199,194	181,607	174,827	149,150	6450	4450	4750	4000
352	223,865	168,605	171,811	158,750	195,892	170,955	168,482	147,076	6550	4100	4850	4300
353	192,785	159,609	150,948	155,408	170,839	141,983	158,260	146,244	4750	3900	3650	3900
354	173,695	158,476	133,996	149,292	157,887	147,865	141,306	137,973	4150	4000	2850	3200
355	206,835	171,156	167,627	133,634	146,361	152,411	135,667	145,766	5550	4450	4500	2650
356	264,310	178,757	173,659	139,694	132,112	151,761	143,535	155,986	7350	6850	3600	1950
357	319,158	198,129	175,532	173,021	242,820	213,842	230,683	215,625	10950	8700	5900	4250
358	251,762	184,239	208,758	198,792	218,686	185,497	190,886	170,273	8050	6750	7100	5500
359	173,362	162,804	168,797	190,305	184,497	171,866	167,348	163,684	3850	4250	4150	4400
360	150,444	175,604	160,979		188,809	177,208	167,355	163,779	2900	3700	3700	
361	158,139	176,563	163,346		178,183	162,778	164,620	158,550	3000	3700	3650	
362	157,474	161,630	155,583		164,207	165,828	152,129	165,200	2350	2900	3000	
363	140,482	152,259	146,150	157,345	146,813	137,249	134,270	137,577	1800	2650	2550	2550
364	144,484	155,459	173,103	192,857	175,580	174,073	158,860	168,084	2050	3250	3350	3300
365	161,852	169,879	153,836	179,466	160,935	162,504	150,899	158,579	3500	3600	2550	2600
366	140,983	133,195	134,530	154,505	138,088	136,049	132,886	136,159	2650	2050	1700	1750

367	150,992	130,486	140,259	166,200	145,866	149,062	144,024	149,695	2550	2050	2200	2400
368	149,313	154,098	150,336	173,352	173,720	165,125	158,403	167,350	2550	5250	4650	3850
369	152,424	179,016	165,420	180,982	178,590	180,624	162,259	168,700	2800	4600	4400	4100
370	164,559	153,406	144,003	166,603	166,923	170,940	155,598	158,409	3500	4100	3150	3500
371	158,466	169,784	161,469	147,505	132,209	135,113	126,435	131,175	3400	4100	4200	2700
372	165,110	165,708	145,050	148,528	144,701	148,657	137,736	141,244	3250	3700	3900	2500
373	169,640	161,091	140,888	172,456	155,247	169,730	147,609	147,911	3550	3900	3600	3100
374	158,175	129,522	157,037	167,348	162,753	170,414	154,087	162,013	3300	3250	3200	3400
375	176,085	179,291	155,307	164,417	155,105	157,768	155,042	156,182	4150	4000	5400	3400
376	172,164	225,579	159,055	142,791	160,222	152,142	155,944	160,853	5400	7350	6200	3550
377	171,544	173,763	156,345	108,568	152,564	147,223	155,621	151,504	4750	6600	4850	2450
378	157,678	187,890	196,337	161,332	186,383	150,969	148,138	151,519	3500	5900	6150	4850
379	157,082	156,305	198,275	194,161	228,674	209,892	194,083	195,271	3400	5900	4950	5050
380	153,001	165,067	189,467	184,018	212,289	185,785	176,732	157,397	3250	4900	4700	4700
381	153,844	149,327	150,781	162,362	167,443	169,602	155,165	152,796	3350	5200	3000	3050
382	143,700	174,472	121,320	153,090	148,624	159,910	133,952	157,896	2300	4550	2300	2600
383	120,704	125,887	123,478	98,749	143,469	138,359	126,301	138,198	1800	3500	3600	1450
384	92,994	141,884	175,302	131,905	182,663	140,913	140,673	140,864	1550	4300	4850	2450
385	94,729	155,548	172,343	150,574	203,057	178,059	170,485	166,953	1700	4500	4900	3650
386	106,754	153,407	156,580	147,264	171,996	174,713	163,670	162,383	2250	4250	4050	3600
387	106,733	153,406	156,787	136,055	171,976	161,727	142,332	153,554	2200	3450	3700	2900
388	151,587	170,870	234,287	117,106	213,603	188,957	194,415	170,840	3200	3750	6400	3200
389	127,753	191,800	223,537	259,331	186,886	181,794	187,515	180,395	1400	5200	5950	7150
390	133,323	156,500	195,195	152,010	174,863	179,004	201,107	185,531	2500	4750	4950	3050
391	118,072	155,355	162,365	177,876	166,769	152,229	164,425	162,953	1700	6500	4350	3650
392	159,661	156,929	165,738	158,906	149,378	154,912	148,342	152,294	2400	4950	6350	3550
393	147,937	158,418	185,016	166,356	189,311	163,015	155,968	154,322	2450	4900	6100	4250
394	128,916	166,735	184,753	229,004	195,319	189,571	194,929	178,992	2100	4150	5000	5350
395	92,023	180,096	183,060	192,970	193,408	198,639	198,244	197,295	1350	3950	4200	4200
396	162,544	163,409	168,977	184,455	150,252	173,100	156,029	162,869	3300	3950	3400	2850
397	133,736	150,754	150,107	152,450	128,889	137,273	133,971	149,323	3000	3500	2300	2350
398	141,218	155,208	163,465	159,643	179,282	156,132	160,103	145,752	2550	3550	3750	2700
399	140,046	123,319	163,077	189,109	161,458	167,230	156,842	165,177	1850	3150	3700	3700
400	118,120	164,971	177,583	167,986	159,487	167,992	155,138	157,162	1900	3700	3700	3700
401	107,385	138,138	175,954	164,455	150,242	152,508	160,053	156,739	2050	3250	3800	3250
402	150,670	157,728	149,094	166,407	190,276	173,789	169,415	171,983	2550	3800	4450	4150
403	138,819	164,555	165,022	151,426	184,518	155,637	160,956	168,872	2100	3950	4950	4100
404	123,172	166,562	175,782	178,510	178,061	168,875	164,169	164,261	1650	3800	4550	4700
405	140,374	159,082	166,262	200,727	173,543	210,320	181,903	190,066	2500	4150	3950	4100
406	177,535	169,125	175,194	169,285	175,946	157,720	151,630	150,113	3400	4350	4850	3450
407	146,806	154,639	152,165	166,556	173,274	152,931	161,855	168,483	3200	3750	4000	3200
408	115,995	132,360	188,976	143,701	168,236	159,607	164,766	165,824	1750	3300	4250	2950
409	140,976	189,881	198,632	122,746	163,662	142,353	141,878	144,079	2700	5750	7550	3050
410	125,679	195,556	230,036	157,464	238,126	207,032	216,943	205,741	1650	6600	7600	3700
411	172,309	184,025	214,065	221,077	228,256	204,123	202,787	192,540	2650	6800	5050	5050
412	119,405	166,545	160,274	150,568	151,420	154,012	155,757	148,065	2050	5100	4100	2300
413	131,702	153,790	128,518	128,339	132,553	149,497	132,240	140,841	2750	4100	3300	2350

414	127,377	140,043	164,097	116,358	161,011	150,933	160,386	134,193	2150	2400	4500	2150
415	184,065	85,218	164,028	116,372	157,608	169,495	168,371	158,728	2550	3850	7000	3000
416	56,786	128,699	169,846	181,523	228,499	223,582	183,688	179,225	1000	4050	6950	4400
417	86,280	126,474	160,440	141,018	141,432	143,141	145,818	137,753	1700	3900	5050	2350
418	84,384	133,820	111,784	81,160	131,645	117,652	117,239	117,781	1750	3350	3350	1300
419	68,030	131,674	145,261	144,581	144,643	140,362	131,345	114,361	1350	3650	4400	3950
420	61,722	116,419	145,673	163,647	161,749	166,695	146,125	130,752	1300	4050	4050	3650
421	51,638	123,699	156,700	192,693	173,263	168,496	153,343	159,133	1100	2650	4100	3800
422	84,883	142,592	131,282	130,401	132,756	147,198	144,554	138,477	1950	3450	4000	2750
423	79,859	125,469	132,450	124,817	172,627	152,287	153,076	146,955	1750	4250	4150	3300
424	93,596	127,872	142,674	159,796	158,597	148,968	171,391	159,208	2200	4250	3550	3750
425	89,110	112,779	119,151	139,835	139,255	144,885	145,092	136,593	1250	2450	2550	2600
426	96,803	108,514	142,718	155,809	158,915	169,277	137,435	139,593	1800	2500	3600	3600
427	111,835	168,500	159,397	178,590	155,854	155,338	159,094	143,907	2050	4600	4400	4100
428	149,597	140,184	125,305	148,397	168,857	159,508	187,711	155,776	2650	5300	2700	3900
429	120,316	132,461	153,663	152,637	179,483	157,680	155,844	146,453	2000	4250	4550	4550
430	187,189	185,038	189,354	133,748	198,611	172,911	191,005	164,308	4650	6950	6600	3100
431	283,020	141,911	155,842	119,488	256,690	173,966	180,745	158,890	10700	6250	7650	3500
432	320,975	207,285	166,219	165,660	166,693	154,602	159,635	154,562	12250	4750	5250	5150
433	161,802	199,939	157,042	153,581	161,977	151,083	153,633	142,165	4250	4150	3800	3850
434	127,525	174,967	150,409	159,247	149,676	145,736	146,353	148,626	2450	3400	3050	3100
435	141,988	140,173	143,504	134,893	130,956	136,099	133,398	151,215	1900	2850	2650	2450

(ft)				Hydraulic Depth (ft)										
1988	1994	2004	2013	1915	1948	1963	1975	1988	1994	2004	2013	1915	1948	1963
2800	3300			63.4	55.0	51.2	48.8	50.8	47.9			2,471,257	2,383,190	2,190,568
2650	3050	2900	2900	63.1	57.3	54.3	49.9	54.6	52.4	51.5	54.5	2,697,269	2,510,222	2,332,374
2000	2450	2450	2450	78.7	68.7	62.5	61.2	67.4	62.5	61.4	62.1	2,816,500	2,704,874	2,314,346
2500	2800	2850	2750	71.6	62.2	60.1	54.0	65.0	54.7	53.7	57.8	2,775,670	2,684,247	2,446,845
2150	2400	2450	2450	69.0	68.2	61.2	57.3	66.4	61.6	56.1	58.7	2,498,472	2,844,142	2,330,977
2550	3100	2950	2950	84.8	94.4	64.3	105.2	101.8	62.5	58.8	69.1	4,584,619	6,657,384	2,990,847
2000	2450	2800	2700	78.3	71.5	59.1	56.1	60.8	55.0	51.0	51.8	2,435,856	2,587,848	2,106,879
2250	2800	2800	2800	65.7	62.8	54.4	49.0	58.3	50.9	50.3	48.8	2,353,591	2,533,040	2,069,176
2100	2500	2450	2500		66.9	62.4	51.0	61.2	51.5	52.4	50.8		2,482,866	2,161,030
2000	2550	2550	2550		64.9	62.1	55.9	62.1	53.1	52.5	53.3		2,515,088	2,289,308
2000	2300	3700	4100		76.8	65.1	72.2	93.9	66.2	54.9	49.5		3,399,199	2,842,388
2600	3200	3250	3300		60.6	54.7	55.0	57.3	47.7	54.0	49.8		3,318,428	2,086,206
1900	2400	2400	2400		47.7	60.9	52.9	65.0	55.8	55.0	54.4		2,259,274	2,072,856
1450	1950	2000	2000		48.3	71.5	61.4	76.4	58.8	61.1	62.2		2,148,855	2,156,686
1700	2500	2600	2600		46.9	56.8	51.0	73.3	51.9	53.3	51.9		2,197,626	2,221,992
2100	2800	3100	3200		56.7	46.9	46.5	62.2	48.8	44.9	44.7		2,386,212	1,861,174
2350	2950	3000	3050		54.0	47.8	46.7	58.5	48.8	53.4	48.6		2,157,152	2,205,945
1400	2950	3050	3050		46.7	55.9	43.9	51.7	32.9	38.4	37.7		1,910,621	1,759,445
1300	2550	2550	2550		59.6	52.1	45.3	53.6	36.0	40.6	38.4		1,954,809	1,706,088
1400	1700	1650	1700		61.8	53.2	60.8	85.3	58.6	66.1	67.6		1,642,474	1,880,538
1350	3100	3050	3050		45.8	35.2	28.9	63.8	39.0	42.9	43.0		1,672,950	1,436,012
2500	3450	3500	3500		35.6	43.0	39.1	40.2	36.0	37.0	36.9		1,193,410	1,662,827
2200	5950	5100	5200		41.0	37.4	29.1	41.8	21.7	24.9	25.6		1,705,251	1,461,814
1950	5550	5300	5500		36.5	40.1	35.1	68.8	27.4	26.3	25.4		2,207,823	1,899,665
1500	2700	4150	4250		59.8	68.3		83.8	44.3	34.8	33.8		2,420,590	2,622,392
2200	3200	4100	4100	92.3	83.1	63.1	46.2	62.5	43.3	35.4	34.6	3,014,655	6,169,480	3,146,644
2950	4100	4100	4100	69.9	45.3	44.6	39.8	48.4	38.5	37.0	34.9	2,193,362	2,161,764	1,906,545
2200	3850	3850	4000	52.9	45.8	43.0	45.2	68.5	49.5	44.7	43.4	2,909,584	2,344,395	2,057,328
2450	3950	4600	5000	41.9	39.6	36.4	34.3	47.7	37.8	34.5	30.8	2,655,098	2,000,323	1,802,296
3650	4100	4150	4200	46.7	38.6	41.9	38.5	40.1	37.1	36.8	34.5	2,182,207	1,785,257	1,917,026
3000	3200		3250	60.1	49.9	52.5	47.0	49.6	48.1		49.5	2,349,016	2,131,083	2,391,226
2700	3050		3050	61.2	52.4	49.7	50.2	52.3	56.4		60.1	2,187,612	2,203,486	1,984,610
1950	2700		2700	70.9	57.0	55.3	57.2	70.7	52.7		50.6	2,492,542	2,193,592	2,087,485
1450	2100		2150	91.1	73.2	69.9	68.2	72.7	60.8		55.9	2,399,076	2,372,202	2,136,255
1050	3000	3100	3100	69.5	51.4	50.0	47.4	74.7	42.8	41.6	40.6	2,469,475	1,988,757	1,763,445
3500	4550	4600	4600	37.8	47.1	41.1	35.5	41.8	35.9	37.0	36.8	1,704,343	2,580,731	2,030,532
3200	3900	3850	3850	47.9	46.1	40.8	39.0	43.1	39.2	38.6	38.4	2,400,589	2,043,183	1,835,499
2700	3550	3300	3300	60.4	47.2	46.5	43.0	51.0	42.1	44.0	43.2	2,553,818	2,000,997	1,835,674
2100	2700	2600	2650	69.7	57.1	55.3	53.2	63.9	51.0	50.6	52.5	2,479,949	2,246,055	2,005,696
1500	2050	2050	2100	80.4	62.8	55.3	56.2	79.6	61.7	61.3	60.8	2,771,113	2,384,399	1,847,162
1800	2700	2850	2850	76.2	67.9	53.3	55.2	70.4	51.6	48.6	50.5	2,737,702	2,709,188	2,073,685
2150	4500	4450	4350	78.2	41.4	30.1	25.8	50.7	29.0	31.9	32.8	2,503,235	1,906,309	1,326,053
2500	3650	3800	3850	66.9	30.4	30.9	31.3	50.3	35.5	39.4	35.5	1,598,303	1,433,373	1,613,848

2500	4800	4650	4600	46.3	39.4	36.6	32.8	45.0	33.5	35.9	35.5	1,551,097	2,122,262	1,914,637
1900	2450	2450	2500	52.2	50.6	46.1	46.0	59.5	51.5	51.2	49.4	2,189,729	2,079,611	1,749,936
1550	2450	2550	2600	68.1	49.9	44.6	46.4	59.9	49.4	48.5	45.6	2,100,728	1,688,731	1,373,231
2350	2750	3050	3050	65.9	51.5	47.7	45.1	47.9	47.3	41.6	42.4	2,095,107	1,890,099	1,628,358
2450	2850	2950	2950	68.9	58.2	50.5	47.3	51.9	48.7	44.9	43.6	2,374,052	2,185,854	1,828,797
1850	2250	2600	2600	75.7	59.8	54.2	52.1	67.4	55.6	47.4	46.0	2,032,991	2,148,718	1,821,990
1100	2600	2600	2600	75.1	49.1	49.8	47.5	98.5	51.6	50.2	45.4	2,005,128	1,746,756	1,751,286
2450	3600	4150	4050	67.8	46.9	45.7	42.6	58.5	48.0	42.3	42.2	2,482,885	2,013,978	2,047,481
2000	3100	3450	3550	64.9	48.9	44.7	45.2	72.8	50.9	42.5	41.2	2,722,001	2,028,342	1,882,895
1350	2350	2300	2300	69.5	45.3	34.8	49.4	71.7	50.6	52.6	48.8	2,349,426	1,754,549	1,337,068
1900	2600	2900	3350	76.8	54.7	57.7	55.2	63.7	58.2	50.6	43.4	2,635,289	2,127,346	2,196,739
2000	2500	2500	2550	77.3	66.5	51.0	47.3	63.1	55.0	54.8	52.4	2,944,539	2,511,550	1,786,588
1900	2600		2550	68.1	47.2	37.0	36.8	59.2	46.3		47.8	2,214,511	1,757,209	1,293,514
2750	3950		4050	47.7	34.0	34.5	33.2	44.3	37.3		34.2	1,879,050	1,447,093	1,625,514
2800	3800		3850	47.0	41.5	42.1	35.5	47.7	37.3		37.0	2,172,441	1,987,146	1,983,286
2200	3300		3350	55.2	47.2	38.3	34.0	52.2	41.3		39.7	2,483,328	2,160,420	1,613,206
2350	2900	2750	2750	61.1	45.2	37.7	38.6	54.3	46.6	46.0	47.2	2,514,265	1,921,996	1,588,882
1950	2400	2350	2500	77.9	55.1	41.6	51.0	59.9	54.1	49.6	44.1	2,629,829	2,072,606	1,449,497
1750	3000	2950	3000	83.8	46.5	38.7	36.3	55.3	43.6	41.1	39.4	2,407,415	1,861,973	1,438,060
1350	3750	3750	3800	68.7	40.3	33.6	26.1	70.6	36.0	37.3	34.8	1,956,831	1,607,522	1,431,043
2700	3950	3850	3900	52.7	36.2	37.3	33.1	53.1	39.8	38.0	33.6	1,891,690	1,644,155	1,770,941
1950	3600	3750	3750	51.0	39.9	40.8	36.6	55.5	38.2	36.4	34.7	2,490,936	1,540,089	1,765,960
1700	3800	3900	4050	54.6	40.4	37.7	32.8	53.4	34.0	35.9	33.4	2,279,240	1,594,081	1,442,807
1900	3100	3450	3400	53.0	44.8	39.0	33.7	53.7	41.7	39.3	38.6	2,170,117	2,032,567	1,637,531
1850	2700	2950	3000	60.0	51.5	46.0	41.5	63.7	45.5	45.0	44.8	2,391,718	2,104,883	1,681,220
2500	4450	5300	5050	79.2	58.8	46.7	43.6	51.0	33.6	37.9	37.4	4,090,726	2,222,850	1,515,953
6150	8200	7050	7100	36.0	29.6	29.8	27.6	32.2	20.8	28.0	24.0	2,021,945	1,661,119	1,705,806
4200	5950	5900	5900	42.0	37.3	35.0	33.2	32.4	33.0	30.2	24.1	2,336,914	1,960,153	1,721,862
1800	4150	4150	4150	44.0	36.3	34.7	36.1	46.6	34.0	33.3	32.6	2,138,403	1,732,728	1,419,592
2450	3700	3000	3050	38.9	37.5	34.0	42.8	50.5	40.7	44.6	43.6	2,408,854	2,101,970	1,429,737
2000	3450	3700	3700	43.9	22.5	38.9	56.2	78.9	47.3	37.5	38.9	3,573,790	1,227,088	1,722,838
2400	4900	5000	5000	54.7	32.3	34.6	33.4	51.9	31.8	29.0	27.4	2,563,709	2,423,015	2,147,164
1550	5300	4900	4900	64.7		36.9	32.7	49.8	29.0	30.9	28.8	2,869,213		2,084,275
3550	4050	4300	4100	78.4		43.7	37.4	37.8	36.7	36.3	34.8	3,085,654		2,035,978
2350	4250	4200	4100	63.4		37.7	33.3	45.6	33.8	34.4	34.5	2,421,236		1,694,853
2050	3450	3300	3400	54.3		37.2	34.4	53.1	39.8	39.0	37.1	2,763,553		1,661,146
1650	2450	2300	2250	67.3		42.1	53.3	62.6	51.5	48.8	51.3	3,228,940		1,780,384
1600	2650	3050	2550	79.0		47.2	42.1	70.4	54.7	42.9	46.2	3,054,504		1,972,034
1400	2850	2950	2950	77.9		55.3	46.9	69.6	54.5	44.5	42.0	2,910,972		2,167,925
3200	3850	3850	3850	58.6		51.6	43.3	41.4	45.2	36.9	36.3	3,712,451		2,393,928
2450	4300	4900	4900	59.0		42.3	33.2	44.4	39.8	31.5	31.6	2,189,610		1,925,299
2600	4150	3600	3800	51.3		44.3	35.2	51.5	40.1	39.0	37.4	2,371,133		1,938,597
1800	3500	3200	3300	48.4	46.8	44.5	52.9	81.2	52.2	43.2	41.0	2,378,677	2,248,944	2,153,558
1000	2300	2350	2400	60.3	57.5	44.2	65.5	85.6	61.6	52.8	47.6	2,644,074	2,786,030	1,766,406
1550	3100	3200	3050	74.3	58.2	44.6	49.9	82.1	50.3	41.5	46.8	2,626,313	2,880,276	1,765,627
1800	3000	3100	3100	71.7	66.9	56.2	61.8	81.9	61.0	54.1	49.8	2,472,563	2,756,212	2,434,360
2450	4350	3900	3900	60.7	52.4	42.0	44.9	72.8	44.0	43.0	40.6	2,247,369	2,821,345	2,127,641

2000	3550	3600	3500	58.6	40.8	37.4	38.4	62.9	46.0	43.4	44.3	2,744,438	2,010,349	1,672,525
2150	3850	3750	3650	57.4	36.6	37.1	45.1	60.9	42.7	43.9	44.7	3,245,678	1,955,893	1,775,364
1900	3950	3700	3800	81.4	40.0	33.1	41.6	60.5	38.2	38.6	35.8	4,052,465	2,363,416	1,671,617
1500	4800	4250	4250	53.4	49.1	32.0	34.9	72.3	33.6	37.9	37.3	2,384,085	2,931,703	1,406,324
4350	4250	4250	4500	46.6	34.1	35.4	32.4	37.4	35.0	37.9	36.5	2,354,216	1,687,394	1,700,695
5450	5650	5750	5950	55.2	38.5	34.5	44.7	34.5	30.7	31.5	27.8	2,358,491	1,711,488	1,626,771
3750	3650	3650	3500	59.8	47.5	40.9	45.2	47.7	46.0	46.4	43.2	2,330,723	2,210,591	1,629,747
2800	2350	2350	2200	59.1	40.2	55.6	55.8	52.8	58.0	59.9	63.1	2,239,414	1,581,938	1,982,263
2200	2050	2100	2250	63.6	44.7	50.3	76.3	62.5	71.6	59.2	60.7	2,683,119	1,661,387	1,884,345
4200	4350	4400	4550	69.6	56.2	68.7	87.7	37.3	30.9	36.0	29.0	2,355,606	2,060,514	2,305,273
5050	4750	4950	5050	64.3	25.9	33.2	41.0	38.1	41.4	31.9	33.1	1,908,154	1,227,047	1,580,277
6300	5700	4200	4500	35.2	31.4	38.1	43.0	34.7	39.9	42.0	38.8	1,757,289	1,776,806	2,291,251
4700	3850	3950	4100	42.2	39.9	43.2	46.5	37.1	45.7	42.6	36.2	2,119,287	2,076,702	1,915,937
3350	3200	3150	3250	62.2	39.5	48.3	50.8	51.3	51.6	48.9	46.4	2,540,127	1,927,192	1,952,348
2900	2550	3150	2750	60.1	43.7	45.7	63.7	54.7	61.5	49.0	52.8	2,257,568	1,950,032	1,957,931
3200	3100	3050	3100	58.8	47.3	51.8	55.0	44.6	49.3	45.9	45.1	2,358,885	1,950,522	2,053,989
3850	3750	4000	4050	59.0	51.5	48.3	49.9	38.3	41.3	33.3	33.8	2,233,666	2,208,618	1,888,202
4800	4450	4550	4550	57.8	39.5	40.7	43.8	36.8	33.5	32.9	32.0	2,765,548	1,603,554	1,662,917
4600	4450	4500	4550	57.2	44.0	44.5	43.0	39.2	32.5	38.3	36.1	2,508,064	2,331,128	2,482,214
4100	4150	4200	4200	61.2	39.6	43.2	44.5	42.6	34.5	41.0	37.7	2,709,697	1,905,546	2,022,528
3800	3700	3750	3750	67.7	42.0	48.5	50.5	44.5	36.2	42.9	42.1	2,757,189	2,079,980	2,001,003
4450	3800	3450	3500	52.2	36.5	50.1	58.2	38.2	42.9	45.0	43.4	2,330,824	1,771,109	1,906,395
2700	2750	2750	2700	58.5	61.7	66.8	70.7	56.0	50.4	49.8	53.5	2,733,553	2,069,710	2,365,807
2650	2150	2250	2200	60.2	67.7	61.9	67.1	57.5	68.2	66.2	77.7	2,406,819	2,304,602	2,084,068
3550	2400	2150	2000	58.9	74.1	61.0	71.4	35.4	53.3	60.7	65.8	2,497,344	2,939,978	2,505,025
3800	3850	3850	4000	41.2	45.9	70.5	64.0	42.4	34.4	34.5	31.6	1,894,533	1,561,365	2,584,960
3550	3550	3700	3750	76.2	32.0	51.7	60.4	39.2	37.5	39.3	38.5	2,465,114	1,517,057	1,938,254
4600	4100	4550	4900	47.0	31.4	42.7	46.9	35.6	43.2	38.9	33.8	2,265,613	1,658,405	2,033,487
5750	5350	3950	4150	40.7	27.5	41.5	49.2	28.8	32.7	41.8	39.7	2,093,761	1,829,707	1,915,916
5500	4400	4050	4500	44.0	29.9	42.2	54.0	28.1	32.8	33.8	34.6	2,250,713	1,481,790	1,888,863
5400	5350	4150	4500	36.9	25.0	36.9	43.5	31.9	30.7	37.8	34.3	2,227,542	986,270	1,841,824
6000	5700	5750	5700	35.5	34.5	35.3	36.6	33.2	31.9	30.4	26.2	2,474,981	1,623,831	1,806,737
5450	5350	5300	5300	34.2	41.1	35.4	36.9	35.9	32.0	31.8	27.8	2,357,664	2,008,761	1,853,201
4300	4350	4250	4200	40.6	40.9	41.4	39.8	39.7	32.6	37.2	34.8	2,276,817	1,895,487	1,805,162
3300	3400	2700	2650	41.9	39.6	47.0	46.7	47.8	43.5	52.3	52.1	2,093,862	1,841,767	1,745,507
3750	3750	3550	3500	37.3	38.5	37.3	50.4	39.0	40.6	38.2	41.6	2,307,699	1,950,211	1,869,673
2600	2750	2850	3400	36.0	26.1	48.2	71.6	50.8	55.2	50.4	45.9	2,879,593	1,572,692	2,301,229
6000	6300	6100	5850	29.1	22.8	29.8	40.7	40.5	33.9	37.8	36.9	3,022,738	1,591,848	1,685,360
6850	6400	5850	5800	31.3	27.3	29.4	36.1	31.9	29.0	32.6	29.4	2,499,115	1,670,198	1,988,681
4150	3900	3950	3950	45.0	38.3	40.7	43.3	44.5	44.1	42.4	41.4	2,194,238	1,850,043	1,996,385
4100	4300	4100	4150	51.9	47.5	43.5		46.1	41.2	40.8	39.5	2,092,640	2,301,913	1,991,349
3700	3750	3750	3700	52.7	47.7	44.8		48.2	43.4	43.9	42.9	2,223,240	2,322,903	2,058,983
3000	3050	3050	3100	67.0	55.7	51.9		54.7	54.4	49.9	53.3	2,597,989	2,358,334	2,163,672
2650	2600	2650	2650	78.0	57.5	57.3	61.7	55.4	52.8	50.7	51.9	2,565,574	2,267,112	2,172,547
3400	3450	3350	3450	70.5	47.8	51.7	58.4	51.6	50.5	47.4	48.7	2,465,276	2,048,516	2,401,462
3700	2900	2800	2900	46.2	47.2	60.3	69.0	43.5	56.0	53.9	54.7	2,085,211	2,218,364	2,366,308
2000	2200	2050	2150	53.2	65.0	79.1	88.3	69.0	61.8	64.8	63.3	1,994,249	2,152,673	2,479,711

2800	2800	2700	2750	59.2	63.7	63.8	69.2	52.1	53.2	53.3	54.4	2,293,833	2,080,203	2,238,396
4350	4200	4200	4250	58.6	29.4	32.3	45.0	39.9	39.3	37.7	39.4	2,251,498	1,466,302	1,525,703
4800	4000	3900	3750	54.4	38.9	37.6	44.1	37.2	45.2	41.6	45.0	2,189,363	2,055,797	1,856,433
4100	3250	3000	2850	47.0	37.4	45.7	47.6	40.7	52.6	51.9	55.6	2,143,657	1,716,124	1,841,096
2950	2350	2300	2400	46.6	41.4	38.4	54.6	44.8	57.5	55.0	54.7	2,052,301	2,032,219	1,839,289
3750	3050	3300	3450	50.8	44.8	37.2	59.4	38.6	48.7	41.7	40.9	2,264,820	2,089,793	1,616,170
3750	3750	3800	3850	47.8	41.3	39.1	55.6	41.4	45.3	38.8	38.4	2,233,891	1,924,910	1,624,007
4150	4450	4500	4550	47.9	39.9	49.1	49.2	39.2	38.3	34.2	35.6	2,087,150	1,511,180	2,104,922
3850	3900	4000	4050	42.4	44.8	28.8	48.4	40.3	40.5	38.8	38.6	2,142,102	2,262,330	1,457,884
5050	4450	4200	4450	31.9	30.7	25.7	40.2	31.7	34.2	37.1	36.1	1,731,041	2,211,252	1,383,521
5700	4500	4450	4650	36.1	26.3	32.2	44.3	26.8	32.7	35.0	32.6	1,874,269	1,537,804	1,583,596
7700	6400	5050	5500	45.1	31.8	31.9	33.3	24.2	23.6	29.3	27.5	1,996,355	1,887,716	1,975,847
5900	6050	5800	6050	46.2	26.5	40.1	38.4	38.8	34.7	33.5	32.3	2,022,512	1,389,051	2,321,193
5150	5600	4950	5100	47.1	33.7	40.3	39.2	41.2	33.2	35.7	30.9	1,994,815	1,721,745	2,227,537
4750	3250	3200	3300	45.9	28.7	50.3	53.2	35.3	52.2	48.5	46.3	1,972,905	1,400,319	2,053,515
3650	2800	2650	3250	62.5	38.3	52.7	58.9	40.7	57.1	50.5	48.6	2,262,597	1,983,980	1,706,344
3750	3050	2650	3050	67.1	36.0	34.3	68.1	38.3	45.4	47.7	45.3	1,992,289	1,371,688	1,303,513
5600	5400	4250	4950	60.0	33.0	36.1	53.8	32.6	26.1	33.1	28.5	1,425,192	1,459,640	1,916,391
5800	5650	5650	5700	55.7	34.6	35.2	41.3	35.0	31.5	30.2	29.3	1,381,986	1,650,557	1,850,087
4350	4750	4250	4550	47.4	36.1	38.7	40.9	39.5	36.8	38.5	35.7	1,399,121	1,675,520	1,790,287
5250	5100	3750	3750	48.5	44.5	42.4	46.9	32.8	31.7	38.0	40.9	1,419,773	1,925,419	1,905,672
9450	7450	6050	6450	47.4	45.6	36.6	36.6	22.6	25.4	32.1	26.5	1,984,582	2,179,829	2,583,020
7350	6650	5600	6350	91.3	36.9	37.6	36.3	25.4	27.3	33.5	28.4	2,589,403	2,125,254	2,507,474
3950	4200	3850	3950	53.3	32.9	39.4	49.8	44.3	42.6	52.2	47.0	1,888,921	1,608,395	2,261,398
5550	4800	4500	4700	69.5	23.9	37.3	48.7	30.0	31.7	36.5	34.7	1,995,020	1,289,042	1,813,404
4250	4700	3800	4350	66.5	31.7	26.1	44.8	35.1	33.0	39.0	35.0	2,621,335	1,571,937	1,458,332
6700	6250	5450	6000	60.4	32.3	30.3	39.1	28.3	26.1	28.6	25.7	2,276,931	1,607,717	1,799,409
5300	5300	5250	5250	61.4	40.2	37.0	42.8	36.9	35.8	37.1	34.1	2,006,155	1,955,901	2,049,610
4550	5700	4800	4500	68.2	45.6	43.6	45.9	42.5	34.8	41.3	43.8	1,535,577	2,298,482	2,267,196
2900	2750	2650	2700	49.3	41.4	49.7	64.7	51.8	62.9	58.9	60.3	2,184,112	1,954,612	2,284,152
2550	2550	2600	2550	44.6	43.1	65.3	64.9	50.5	53.8	51.5	58.6	1,681,384	1,852,415	2,433,241
4050	4050	4000	4150	55.4	43.7	43.6	59.1	44.3	38.6	40.0	35.1	2,051,738	1,926,213	2,024,675
4050	4050	4150	4200	75.7	39.1	44.1	51.1	39.9	41.3	37.8	39.3	2,506,119	1,421,822	2,034,793
4300	3850	3900	3800	62.2	44.6	48.0	45.4	37.1	43.6	39.8	41.4	1,853,691	2,074,322	2,345,311
3700	3350	3450	3600	52.4	42.5	46.3	50.6	40.6	45.5	46.4	43.5	1,503,377	1,682,413	2,268,874
5650	5250	5300	5350	59.1	41.5	33.5	40.1	33.7	33.1	32.0	32.1	2,285,699	1,890,857	1,549,515
5150	5000	5050	5000	66.1	41.7	33.3	36.9	35.8	31.1	31.9	33.8	2,269,532	1,977,510	1,709,356
4900	4700	4700	4300	74.6	43.8	38.6	38.0	36.3	35.9	34.9	38.2	2,183,733	2,070,645	2,008,852
4400	4100	4000	3950	56.1	38.3	42.1	49.0	39.4	51.3	45.5	48.1	2,058,341	1,808,566	2,011,817
4900	3700	2950	3050	52.2	38.9	36.1	49.1	35.9	42.6	51.4	49.2	2,480,214	1,940,985	1,914,424
3900	3200	3200	3350	45.9	41.2	38.0	52.0	44.4	47.8	50.6	50.3	1,881,365	1,845,769	1,721,154
9100	5450	4450	5200	66.3	40.1	44.5	48.7	18.5	29.3	37.0	31.9	1,899,785	1,550,909	2,371,839
5950	4900	4300	4800	52.2	33.0	26.3	40.2	27.5	29.1	33.0	30.0	1,969,386	1,954,440	1,757,046
8300	8100	7100	8100	76.2	29.6	30.3	42.6	28.7	25.6	30.6	25.4	2,258,299	1,872,499	2,234,173
7100	6250	5750	5650	65.0	27.1	42.4	43.8	32.1	32.7	35.3	34.1	2,786,211	1,658,775	2,602,437
5200	3050	2900	2800	58.2	32.7	39.1	65.5	29.1	50.5	53.7	52.9	1,794,178	1,701,528	1,846,070
2000	2050	2100	2150	47.9	37.5	38.9	54.6	66.3	72.9	63.0	65.5	1,736,869	1,723,290	1,476,613

4850	4500	4400	4500	59.2	58.4	36.5	54.1	33.2	33.5	36.5	29.8	1,935,791	2,106,832	1,804,511
6350	5750	5550	5650	72.2	22.1	23.4	38.8	24.8	29.5	30.3	28.1	3,190,996	671,810	1,343,178
7050	6350	4000	3900	56.8	31.8	24.4	41.3	32.4	35.2	45.9	46.0	838,959	1,291,181	1,430,328
3200	2950	2550	2700	50.8	32.4	31.8	60.0	44.2	48.5	57.2	51.0	1,182,723	1,286,156	1,609,380
5250	3550	2200	2450	48.2	39.9	33.4	62.4	25.1	33.1	53.3	48.1	1,117,906	1,563,763	1,158,615
4600	4600	3500	4600	50.4	36.1	33.0	36.6	31.4	30.5	37.5	24.9	928,140	1,437,604	1,494,909
4450	4500	3950	3800	47.5	28.7	36.0	44.8	36.3	37.0	37.0	34.4	809,295	1,092,460	1,587,305
4600	4200	3400	3450	46.9	46.7	38.2	50.7	37.7	40.1	45.1	46.1	671,976	1,603,673	1,777,974
3900	4000	4000	4150	43.5	41.3	32.8	47.4	34.0	36.8	36.1	33.4	1,050,372	1,704,551	1,345,767
4750	4800	4750	4900	45.6	29.5	31.9	37.8	36.3	31.7	32.2	30.0	1,019,802	1,198,489	1,332,674
4000	4000	4100	4150	42.5	30.1	40.2	42.6	39.6	37.2	41.8	38.4	1,140,646	1,236,994	1,673,998
2950	3100	3100	3000	71.3	46.0	46.7	53.8	47.2	46.7	46.8	45.5	1,532,038	1,448,566	1,545,735
3950	3950	4000	4150	53.8	43.4	39.6	43.3	40.2	42.9	34.4	33.6	1,379,230	1,340,241	1,659,325
4500	4000	4100	4000	54.6	36.6	36.2	43.6	34.6	38.8	38.8	36.0	1,608,642	1,858,493	1,745,149
4700	4400	4450	4500	56.5	26.4	46.4	38.1	35.9	36.3	42.2	34.6	2,201,432	1,244,460	1,618,222
5800	5550	5650	5650	60.2	31.2	33.8	33.5	30.9	28.4	27.6	25.9	1,847,234	1,311,852	1,605,492
7150	6700	6650	6550	40.3	26.6	28.7	43.1	27.8	25.8	28.7	25.1	2,198,692	1,649,850	1,774,572
7800	7450	6300	5850	26.5	22.7	20.4	34.1	32.9	23.4	28.7	27.2	2,512,501	1,137,906	1,162,434
5700	5350	4000	4000	26.2	43.6	31.7	32.2	29.2	28.9	39.9	38.6	2,831,575	2,569,308	1,663,520
4200	4150	4050	4050	38.1	48.2	41.3	39.9	38.6	36.4	37.9	35.1	1,831,105	2,647,256	1,877,177
3400	3250	3200	3250	52.1	51.5	49.3	51.4	44.0	44.8	45.7	45.7	1,777,789	2,420,692	2,022,656
2700	2550	2700	2700	74.7	49.2	54.2	55.1	48.5	53.4	49.4	56.0	2,519,132	1,881,683	2,054,048

Conveyance (AD ^{2/3})					Width/Depth Ratio								
1975	1988	1994	2004	2013	1915	1948	1963	1975	1988	1994	2004	2013	
2,050,870	1,948,902	2,081,317			38.6	54.6	60.5	64.6	55.2	69.0			
2,200,661	2,084,693	2,239,648	2,068,717	2,274,414	42.8	51.5	55.3	65.1	48.5	58.2	56.3	53.2	
2,279,357	2,234,395	2,408,549	2,343,242	2,383,583	24.8	34.2	37.6	39.2	29.7	39.2	39.9	39.5	
2,119,109	2,630,113	2,208,639	2,180,357	2,374,132	31.4	44.2	44.1	51.0	38.4	51.2	53.0	47.6	
2,172,676	2,339,365	2,308,388	2,015,029	2,174,318	31.1	36.7	40.0	44.5	32.4	38.9	43.7	41.7	
6,442,813	5,658,278	3,051,706	2,621,533	3,432,110	33.0	36.0	45.1	26.2	25.1	49.6	50.2	42.7	
2,011,998	1,879,091	1,951,249	1,964,528	1,943,168	21.7	29.4	39.8	43.7	32.9	44.5	54.9	52.1	
1,872,978	1,974,233	1,958,610	1,921,152	1,823,375	33.5	40.6	48.7	58.1	38.6	55.0	55.6	57.4	
1,821,350	1,996,648	1,780,629	1,795,328	1,741,812		33.6	35.2	51.0	34.3	48.6	46.8	49.2	
2,042,726	1,945,868	1,911,007	1,879,824	1,923,201		37.0	37.8	44.7	32.2	48.1	48.5	47.9	
3,068,317	3,882,610	2,489,702	2,934,955	2,737,990		31.9	41.5	33.9	21.3	34.8	67.4	82.8	
2,385,715	2,215,646	2,005,124	2,510,264	2,226,575		58.6	48.5	54.6	45.4	67.1	60.1	66.2	
1,863,600	1,994,117	1,955,296	1,906,735	1,871,606		75.5	36.1	47.3	29.3	43.0	43.7	44.2	
1,911,654	1,996,203	1,735,206	1,896,621	1,953,555		69.3	24.5	32.6	19.0	33.1	32.7	32.1	
1,928,500	2,180,143	1,803,356	1,961,534	1,880,051		76.7	46.7	53.9	23.2	48.2	48.8	50.1	
1,683,351	2,052,903	1,825,746	1,759,851	1,803,375		50.2	65.0	60.2	33.7	57.4	69.0	71.5	
1,843,978	2,073,787	1,921,024	2,273,201	1,976,356		51.9	73.2	65.4	40.1	60.5	56.2	62.7	
1,391,604	1,005,632	997,782	1,331,384	1,293,501		67.4	38.4	58.1	27.1	89.6	79.5	80.9	
1,469,931	989,833	1,000,235	1,225,473	1,114,010		36.1	45.1	56.2	24.3	70.9	62.7	66.4	
2,161,713	2,316,101	1,504,410	1,785,188	1,908,611		27.5	47.0	37.8	16.4	29.0	24.9	25.1	
993,010	1,375,469	1,387,736	1,602,007	1,608,431		62.2	108.0	126.3	21.2	79.6	71.1	71.0	
1,375,678	1,181,550	1,356,505	1,438,794	1,428,791		87.1	73.2	77.9	62.1	95.7	94.6	95.0	
1,280,749	1,107,846	1,002,782	1,082,964	1,154,115		85.4	93.7	159.8	52.6	274.5	204.8	203.4	
1,732,043	2,252,356	1,381,874	1,229,898	1,210,780		150.7	101.1	131.0	28.3	202.6	201.8	216.1	
	2,405,147	1,498,289	1,540,287	1,502,463			44.3	33.7		17.9	60.9	119.2	125.7
1,934,646	2,163,103	1,711,198	1,566,431	1,507,025	17.3	46.9	50.0	70.3	35.2	73.8	115.7	118.5	
1,807,580	1,894,409	1,798,936	1,686,503	1,528,705	26.5	82.7	76.2	98.0	61.0	106.5	110.7	117.5	
2,350,773	2,522,537	2,565,394	2,164,368	2,140,382	73.7	87.4	90.7	90.7	32.1	77.8	86.2	92.3	
1,504,533	1,538,270	1,678,116	1,681,000	1,511,663	125.3	109.9	123.5	120.9	51.3	104.6	133.4	162.4	
1,730,666	1,714,997	1,692,558	1,686,955	1,539,040	77.0	104.9	90.8	102.7	91.0	110.5	112.9	121.6	
1,992,574	2,005,555	2,034,470		2,170,908	42.5	63.1	61.9	69.1	60.5	66.6		65.6	
2,086,987	1,977,205	2,528,979		2,814,931	37.6	57.2	59.3	60.7	51.6	54.1		50.7	
2,210,806	2,356,684	2,001,051		1,866,898	28.9	45.6	47.0	45.4	27.6	51.2		53.4	
2,104,140	1,837,737	1,971,640		1,758,671	14.3	25.3	25.7	27.1	19.9	34.6		38.4	
1,830,018	1,390,744	1,568,746	1,547,373	1,486,213	30.2	54.5	52.0	62.3	14.1	70.2	74.5	76.4	
1,669,344	1,759,517	1,778,023	1,893,890	1,873,143	105.8	89.2	101.0	122.5	83.8	126.7	124.2	125.0	
1,706,979	1,695,022	1,762,068	1,700,792	1,684,342	79.3	74.9	93.2	97.3	74.3	99.6	99.6	100.2	
1,712,989	1,891,666	1,806,549	1,813,041	1,752,681	45.6	68.9	65.6	75.6	53.0	84.4	74.9	76.5	
2,028,880	2,144,581	1,893,298	1,801,204	1,949,007	30.1	46.4	45.2	50.8	32.9	52.9	51.4	50.5	
1,816,711	2,208,930	1,972,603	1,952,757	1,976,744	23.0	38.2	41.6	39.1	18.8	33.2	33.5	34.5	
2,358,400	2,162,695	1,930,822	1,844,850	1,963,370	26.3	35.4	51.6	53.5	25.6	52.3	58.6	56.5	
1,061,304	1,493,047	1,234,595	1,425,404	1,460,008	22.4	93.0	151.1	181.9	42.4	155.0	139.6	132.7	
1,165,634	1,712,517	1,398,139	1,733,251	1,478,688	21.7	159.7	171.4	119.8	49.7	102.9	96.5	108.3	

1,614,859	1,423,750	1,674,992	1,818,579	1,760,358	56.2	118.0	129.9	146.3	55.5	143.1	129.4	129.7
1,654,839	1,723,505	1,745,554	1,726,966	1,664,363	57.4	59.2	64.0	60.8	31.9	47.6	47.9	50.6
1,377,095	1,421,914	1,631,188	1,642,136	1,515,239	27.2	50.1	55.0	49.6	25.9	49.6	52.6	57.0
1,542,043	1,486,206	1,702,434	1,524,224	1,570,805	29.6	51.4	54.6	59.9	49.0	58.1	73.3	72.0
1,734,149	1,768,003	1,848,467	1,672,056	1,591,732	29.8	42.9	52.5	59.2	47.2	58.6	65.7	67.7
1,741,539	2,066,489	1,824,798	1,613,661	1,536,587	19.8	39.3	43.4	46.1	27.4	40.4	54.9	56.5
1,715,874	2,312,514	1,859,429	1,778,215	1,499,496	20.0	53.9	52.2	57.8	11.2	50.4	51.8	57.3
1,869,564	2,160,487	2,285,103	2,128,381	2,068,316	32.4	70.3	76.5	84.5	41.9	74.9	98.2	96.1
1,918,924	2,540,826	2,170,398	1,783,644	1,742,351	40.1	63.4	75.0	74.2	27.5	60.8	81.2	86.2
1,596,490	1,671,829	1,626,937	1,698,942	1,499,706	28.8	67.4	103.4	48.6	18.8	46.4	43.7	47.1
2,080,400	1,927,919	2,269,675	2,005,500	1,797,098	24.7	49.4	44.2	47.1	29.9	44.7	57.3	77.1
1,824,550	1,999,653	1,988,423	1,973,877	1,869,595	27.2	34.6	50.0	62.4	31.7	45.5	45.7	48.7
1,325,473	1,710,468	1,552,123		1,608,094	28.6	60.4	85.2	88.2	32.1	56.2		53.3
1,491,970	1,525,586	1,647,392		1,461,468	63.0	119.0	129.1	131.0	62.1	105.8		118.3
1,570,167	1,757,914	1,582,784		1,580,928	75.5	96.5	92.7	115.6	58.7	101.9		104.1
1,232,978	1,602,860	1,630,503		1,545,402	56.1	74.1	96.5	101.4	42.2	79.8		84.5
1,430,617	1,827,478	1,748,689	1,621,735	1,693,007	43.3	74.1	99.5	84.3	43.3	62.3	59.8	58.3
1,614,342	1,788,718	1,856,408	1,573,547	1,377,406	23.7	47.2	69.7	45.1	32.5	44.4	47.4	56.7
1,331,303	1,402,883	1,619,212	1,442,903	1,367,812	17.9	66.7	84.0	92.4	31.7	68.8	71.8	76.2
998,025	1,627,051	1,473,618	1,563,190	1,407,228	24.8	84.5	122.2	166.8	19.1	104.1	100.5	109.3
1,499,119	2,022,693	1,833,779	1,651,162	1,365,292	48.3	114.6	113.9	133.1	50.9	99.2	101.4	116.0
1,590,625	1,572,800	1,560,840	1,502,347	1,384,896	69.6	82.6	89.4	108.0	35.2	94.2	102.9	108.0
1,259,869	1,288,885	1,353,396	1,524,186	1,399,557	53.1	82.9	90.1	114.4	31.8	111.9	108.6	121.4
1,245,451	1,451,722	1,557,144	1,564,138	1,500,876	54.7	80.4	93.6	105.5	35.4	74.3	87.9	88.0
1,343,366	1,879,102	1,563,788	1,677,728	1,695,629	43.3	57.3	62.0	65.1	29.0	59.4	65.6	67.0
1,591,335	1,755,354	1,560,390	2,264,230	2,110,416	35.3	42.5	53.5	67.7	49.0	132.3	139.9	135.1
1,621,024	2,002,149	1,288,620	1,824,499	1,420,304	143.0	197.3	199.6	234.1	191.1	394.5	251.4	295.5
1,683,626	1,383,930	2,016,011	1,724,812	1,184,923	109.5	125.9	131.5	147.4	129.6	180.5	195.6	245.0
1,576,279	1,085,718	1,482,520	1,428,672	1,382,457	88.6	119.8	111.0	110.8	38.6	122.0	124.7	127.2
1,915,066	1,687,614	1,781,674	1,680,127	1,649,512	138.9	133.3	117.5	85.2	48.6	90.9	67.3	69.9
2,883,399	2,900,208	2,130,837	1,554,916	1,653,488	149.3	304.6	98.9	62.3	25.4	73.0	98.7	95.1
1,767,816	1,731,536	1,565,974	1,370,810	1,243,900	59.4	229.2	169.2	152.6	46.3	154.0	172.3	182.6
1,521,785	1,046,528	1,453,109	1,494,287	1,326,977	42.5		138.3	139.1	31.1	182.6	158.4	170.1
1,634,645	1,511,792	1,642,849	1,711,472	1,523,388	27.4		85.7	104.1	93.9	110.3	118.4	117.7
1,431,699	1,366,057	1,499,904	1,529,470	1,497,674	37.8		106.1	124.6	51.6	125.8	122.0	118.9
1,399,368	1,538,325	1,603,594	1,478,542	1,403,775	65.4		107.4	112.0	38.6	86.6	84.7	91.6
1,772,216	1,629,504	1,744,870	1,497,236	1,591,755	43.1		83.2	44.1	26.3	47.6	47.2	43.9
1,655,920	1,919,978	2,088,199	1,606,367	1,519,084	26.6		67.8	77.2	22.7	48.5	71.0	55.1
1,645,142	1,649,142	2,232,891	1,651,462	1,494,970	26.3		48.8	57.6	20.1	52.3	66.2	70.3
1,839,304	1,585,048	2,206,520	1,577,790	1,532,767	71.7		65.0	79.7	77.3	85.2	104.2	106.0
1,511,885	1,366,353	1,993,188	1,536,200	1,551,409	41.5		88.7	132.4	55.1	108.1	155.8	154.8
1,569,247	1,853,072	1,953,602	1,614,199	1,591,368	65.3		79.1	117.9	50.5	103.4	92.3	101.5
2,687,414	2,743,457	2,549,278	1,702,785	1,609,485	76.4	79.1	86.5	68.0	22.2	67.1	74.1	80.5
2,447,261	1,664,012	2,211,950	1,745,356	1,500,059	47.2	56.5	72.4	35.1	11.7	37.3	44.5	50.4
2,195,695	2,404,183	2,123,319	1,590,516	1,855,982	26.9	56.7	70.7	65.2	18.9	61.7	77.1	65.1
2,755,128	2,781,468	2,838,181	2,396,920	2,092,843	27.9	37.4	52.5	46.1	22.0	49.2	57.3	62.2
2,491,427	3,107,684	2,383,452	2,060,937	1,872,385	39.6	73.5	100.1	98.1	33.7	98.9	90.6	96.0

1,990,756	1,987,483	2,098,726	1,928,333	1,942,204	52.9	101.6	107.0	118.4	31.8	77.1	83.0	79.0
2,253,551	2,024,552	2,008,454	2,050,700	2,053,426	66.2	132.5	115.9	87.7	35.3	90.2	85.4	81.7
1,851,528	1,769,644	1,710,455	1,629,098	1,478,654	32.6	126.2	148.1	88.8	31.4	103.4	95.9	106.1
1,583,225	1,880,053	1,677,473	1,816,542	1,767,212	59.0	90.6	135.7	121.8	20.8	143.0	112.2	114.0
1,401,849	1,821,848	1,591,584	1,817,615	1,805,802	83.7	137.7	125.6	131.0	116.2	121.4	112.1	123.3
1,603,490	1,989,994	1,704,383	1,807,777	1,521,075	53.5	101.3	129.0	63.8	158.1	183.8	182.5	213.8
1,980,151	2,350,122	2,156,589	2,190,105	1,865,124	42.7	74.8	81.8	76.3	78.7	79.3	78.6	80.9
2,119,805	2,081,612	2,042,319	2,154,702	2,199,678	42.3	83.3	44.1	46.6	53.0	40.5	39.2	34.9
2,815,525	2,164,974	2,528,765	1,889,018	2,111,398	41.7	66.0	54.7	26.9	35.2	28.6	35.5	37.0
2,337,531	1,746,367	1,321,443	1,726,925	1,245,553	28.7	44.5	29.1	15.4	112.7	140.9	122.2	156.9
1,851,192	2,174,655	2,356,515	1,589,500	1,723,116	28.8	208.2	138.4	92.7	132.7	114.6	155.1	152.6
2,950,690	2,326,896	2,650,682	2,129,656	1,997,695	132.1	181.8	138.9	130.4	181.5	143.0	100.0	116.1
2,496,075	1,938,070	2,244,994	2,048,842	1,627,069	98.4	111.4	83.3	89.2	126.7	84.3	92.8	113.1
2,470,180	2,369,053	2,290,214	2,061,434	1,950,232	41.8	106.2	63.2	69.9	65.4	62.0	64.4	70.0
2,594,211	2,287,548	2,440,754	2,068,461	2,045,551	40.8	82.4	73.3	40.0	53.0	41.5	64.3	52.1
2,264,586	1,797,765	2,053,035	1,792,742	1,771,081	45.0	66.6	55.0	51.9	71.7	62.9	66.5	68.7
1,994,336	1,674,358	1,851,659	1,378,555	1,431,014	42.4	60.2	61.1	59.1	100.6	90.8	120.1	119.8
2,093,974	1,955,707	1,550,893	1,537,618	1,464,443	55.4	88.6	84.7	87.9	130.4	132.7	138.3	142.4
2,344,194	2,082,315	1,475,805	1,959,750	1,798,037	51.5	96.6	100.1	103.6	117.3	136.8	117.4	125.9
2,093,866	2,130,597	1,516,848	2,046,074	1,782,138	46.6	104.9	87.9	84.3	96.2	120.3	102.5	111.3
2,275,794	2,119,596	1,467,720	1,974,071	1,913,804	36.2	97.6	63.9	65.4	85.5	102.1	87.3	89.0
2,712,090	1,924,656	1,995,889	1,960,582	1,873,958	61.3	120.4	55.9	53.2	116.6	88.6	76.8	80.7
2,780,500	2,212,723	1,891,953	1,856,524	2,052,455	53.0	34.9	32.2	32.5	48.2	54.5	55.2	50.4
2,605,714	2,269,410	2,445,453	2,437,373	3,112,566	43.2	30.3	34.7	35.0	46.1	31.5	34.0	28.3
3,437,118	1,357,747	1,809,240	2,016,198	2,146,480	47.5	30.4	43.4	39.2	100.2	45.1	35.4	30.4
2,253,100	1,957,869	1,403,541	1,404,405	1,260,744	93.4	57.7	30.5	34.4	89.7	111.8	111.7	126.7
2,511,948	1,602,464	1,493,422	1,682,063	1,648,571	23.6	146.8	52.2	44.7	90.7	94.6	94.1	97.3
2,254,665	1,770,917	2,180,369	2,032,866	1,731,565	78.7	168.7	91.4	78.9	129.3	94.9	116.9	145.0
1,784,226	1,553,504	1,787,621	1,989,156	1,917,080	106.9	265.4	92.7	54.9	199.8	163.7	94.5	104.5
1,542,374	1,427,696	1,477,439	1,433,331	1,656,587	93.1	172.4	87.8	37.0	195.8	134.2	119.7	129.9
1,668,975	1,735,956	1,609,688	1,767,184	1,631,663	147.8	183.7	121.9	71.2	169.1	174.3	109.8	131.1
1,612,164	2,057,597	1,825,182	1,703,082	1,314,593	181.6	129.1	134.5	109.4	180.7	178.9	189.1	217.8
1,760,128	2,133,520	1,721,476	1,690,714	1,348,089	191.6	99.7	136.9	116.5	151.6	167.4	166.7	191.0
1,813,057	1,989,140	1,450,109	1,764,794	1,559,419	117.0	95.3	88.3	97.9	108.2	133.3	114.1	120.6
1,934,759	2,080,822	1,828,628	1,977,091	1,923,792	99.2	101.0	60.6	68.6	69.0	78.2	51.6	50.9
1,824,030	1,684,054	1,801,669	1,539,234	1,751,381	148.9	115.7	120.8	52.6	96.1	92.3	92.9	84.0
2,409,563	1,812,407	2,199,769	1,957,502	1,999,058	204.4	262.5	74.6	27.2	51.2	49.8	56.6	74.1
2,047,562	2,862,246	2,241,787	2,598,997	2,388,148	375.7	382.0	198.3	104.4	148.3	185.6	161.3	158.7
2,173,147	2,200,772	1,750,282	1,949,184	1,620,404	257.4	247.3	241.5	152.2	214.6	220.8	179.3	197.6
2,344,850	2,315,351	2,144,245	2,033,777	1,960,104	85.5	110.9	102.0	101.7	93.3	88.5	93.2	95.3
	2,425,760	2,114,261	1,984,006	1,898,449	55.9	78.0	85.0		89.0	104.3	100.4	105.2
	2,358,530	2,010,498	2,048,561	1,941,520	56.9	77.5	81.6		76.8	86.4	85.4	86.3
	2,367,215	2,379,934	2,061,349	2,339,413	35.1	52.0	57.8		54.8	56.1	61.1	58.2
2,456,938	2,133,581	1,931,369	1,838,521	1,914,596	23.1	46.1	44.5	41.3	47.8	49.3	52.3	51.0
2,904,358	2,434,854	2,376,873	2,081,275	2,242,150	29.1	67.9	64.8	56.5	65.8	68.4	70.6	70.8
3,019,876	1,990,448	2,379,613	2,152,984	2,284,595	75.7	76.3	42.3	37.7	85.1	51.8	52.0	53.0
3,063,459	2,324,021	2,127,547	2,144,349	2,163,311	49.8	31.6	21.5	19.8	29.0	35.6	31.6	33.9

2,802,701	2,034,635	2,109,472	2,040,874	2,150,102	43.1	32.2	34.5	34.7	53.7	52.6	50.6	50.5
2,194,025	2,029,668	1,909,224	1,781,455	1,936,950	43.5	178.9	143.8	85.5	108.9	106.8	111.4	107.9
2,260,492	1,990,379	2,290,444	1,948,220	2,133,890	51.4	118.2	117.0	92.9	129.0	88.6	93.7	83.4
2,188,228	1,975,473	2,399,676	2,164,009	2,307,108	74.4	109.6	68.9	73.5	100.7	61.8	57.8	51.3
2,123,745	1,668,101	2,012,732	1,827,930	1,889,206	72.9	99.0	109.2	49.4	65.8	40.9	41.8	43.9
2,261,444	1,652,335	1,983,557	1,657,304	1,677,795	64.0	82.6	104.9	42.1	97.2	62.6	79.1	84.3
2,513,182	1,857,873	2,155,643	1,693,039	1,684,071	74.3	94.4	92.0	55.7	90.6	82.9	97.8	100.2
2,247,568	1,878,669	1,936,126	1,624,801	1,753,509	68.8	81.5	65.2	69.1	105.8	116.2	131.4	127.8
2,182,349	1,822,783	1,859,185	1,775,722	1,782,719	97.8	89.2	187.8	70.3	95.6	96.4	103.2	105.0
1,676,284	1,605,741	1,602,657	1,735,590	1,758,495	169.4	239.5	241.7	88.3	159.2	130.2	113.1	123.1
1,359,534	1,365,123	1,505,978	1,664,208	1,545,516	131.5	250.7	150.5	55.3	213.0	137.5	127.2	142.7
1,668,684	1,559,608	1,241,734	1,409,014	1,382,084	77.7	185.3	192.6	145.8	318.1	271.3	172.2	199.6
2,211,789	2,618,955	2,232,654	2,015,404	1,979,519	73.6	222.7	123.6	131.3	152.2	174.4	173.3	187.4
2,121,792	2,533,227	1,918,198	1,916,265	1,548,627	69.0	145.5	116.6	120.0	124.9	168.8	138.6	165.3
2,297,592	1,800,187	2,368,441	2,063,274	1,970,209	72.9	181.1	59.7	57.3	134.7	62.3	66.0	71.3
2,317,016	1,759,078	2,371,482	1,831,270	2,102,298	36.8	118.7	43.6	44.2	89.6	49.0	52.4	66.9
1,646,793	1,628,949	1,759,857	1,660,273	1,756,454	26.8	97.3	105.0	21.3	98.0	67.2	55.6	67.3
1,880,723	1,864,763	1,239,712	1,450,193	1,312,997	25.8	130.3	134.2	45.5	171.7	206.9	128.4	173.9
1,797,716	2,173,083	1,776,537	1,652,382	1,586,385	30.5	130.2	139.3	88.5	165.7	179.3	187.2	194.6
1,748,345	1,996,195	1,932,323	1,866,476	1,760,193	47.4	117.7	104.8	88.0	110.0	129.1	110.4	127.5
1,769,808	1,760,646	1,620,280	1,607,499	1,824,234	45.3	77.6	87.3	61.8	160.3	160.8	98.8	91.6
1,290,826	1,707,624	1,631,177	1,965,074	1,518,012	67.6	82.3	174.8	87.4	418.1	293.7	188.3	243.5
2,841,531	1,615,979	1,649,755	1,948,055	1,679,540	15.3	141.0	158.4	197.1	289.1	243.3	167.2	223.5
2,058,669	2,188,257	2,184,090	2,810,210	2,415,263	46.9	144.2	125.5	61.2	89.2	98.5	73.7	84.1
2,373,192	1,611,876	1,525,223	1,810,525	1,732,621	24.5	272.0	116.5	74.9	184.7	151.4	123.2	135.6
2,003,319	1,602,828	1,592,482	1,707,076	1,629,844	36.1	156.1	243.3	79.3	120.9	142.6	97.3	124.2
1,917,798	1,756,213	1,433,702	1,459,239	1,344,665	40.6	151.6	201.1	108.6	237.1	239.6	190.4	233.3
2,802,216	2,163,009	2,057,951	2,169,478	1,881,987	34.2	103.3	135.3	125.0	143.8	148.2	141.4	154.0
2,475,421	2,355,676	2,119,300	2,368,678	2,453,116	19.8	86.6	96.4	91.4	107.0	163.6	116.2	102.6
2,973,410	2,088,192	2,739,095	2,361,448	2,505,083	67.0	95.5	68.4	44.0	56.0	43.7	45.0	44.8
2,461,309	1,761,983	1,957,103	1,855,103	2,251,735	67.3	81.3	35.2	36.2	50.5	47.4	50.5	43.5
2,422,931	2,243,485	1,781,754	1,873,388	1,563,116	46.0	81.2	86.0	45.7	91.5	105.1	99.9	118.2
2,604,467	1,884,202	1,997,811	1,766,333	1,910,213	24.4	80.5	83.9	72.4	101.6	98.1	109.8	106.8
2,137,902	1,773,772	2,082,133	1,807,817	1,879,569	30.6	83.0	77.1	81.5	115.9	88.2	98.0	91.9
2,249,872	1,774,934	1,944,430	2,066,454	1,939,811	39.1	76.5	82.1	64.2	91.1	73.6	74.4	82.7
1,949,486	1,984,300	1,791,699	1,706,359	1,738,756	43.2	91.6	132.8	103.5	167.8	158.6	165.8	166.4
1,679,356	2,005,360	1,540,068	1,618,019	1,764,470	31.8	94.8	148.5	111.0	143.7	160.6	158.4	148.0
2,017,008	1,953,519	1,838,843	1,754,229	1,863,132	22.1	86.7	117.8	123.7	134.8	130.8	134.6	112.6
2,686,287	2,010,845	2,903,651	2,317,538	2,514,437	44.5	108.3	93.8	83.7	111.6	79.9	88.0	82.1
2,268,912	1,915,004	1,924,616	2,096,172	2,016,034	65.1	111.9	134.3	70.3	136.5	86.8	57.4	62.0
2,321,843	2,173,600	2,013,988	2,213,653	2,295,595	69.8	90.9	105.1	61.5	87.8	67.0	63.3	66.6
1,916,681	1,176,267	1,516,425	1,830,376	1,667,547	26.4	82.3	95.6	60.6	492.2	186.1	120.2	163.1
1,441,488	1,491,309	1,345,279	1,459,533	1,391,572	51.7	174.1	287.0	75.8	216.3	168.7	130.3	159.9
1,919,401	2,231,650	1,796,415	2,120,334	1,777,785	21.7	222.7	251.1	86.9	289.3	316.9	232.4	318.9
2,746,069	2,307,805	2,085,611	2,180,831	2,023,801	40.8	251.3	119.1	115.4	220.8	191.4	163.0	165.8
2,445,701	1,433,182	2,104,059	2,217,236	2,086,005	35.2	156.2	104.9	35.1	178.6	60.4	54.0	52.9
1,847,360	2,170,860	2,609,479	2,093,104	2,288,694	57.4	109.3	84.7	43.0	30.2	28.1	33.3	32.8

1,664,832	1,663,154	1,569,760	1,763,229	1,290,458	36.3	41.1	123.4	39.7	146.1	134.2	120.7	150.9
1,333,522	1,341,061	1,617,401	1,637,757	1,466,868	35.3	173.9	298.7	77.3	255.8	195.1	182.9	201.1
2,167,302	2,322,814	2,401,843	2,355,569	2,299,427	17.6	127.4	284.4	106.7	217.5	180.3	87.1	84.9
2,161,449	1,767,980	1,904,261	2,164,347	1,894,930	33.5	120.3	159.0	39.2	72.4	60.8	44.6	52.9
1,277,244	1,127,811	1,213,887	1,660,246	1,557,212	36.3	83.9	100.4	20.8	209.4	107.1	41.3	51.0
1,593,882	1,440,971	1,370,598	1,472,230	974,145	26.8	101.2	133.3	107.9	146.3	150.8	93.3	185.0
2,065,299	1,774,859	1,852,386	1,622,346	1,383,217	27.4	140.9	112.6	81.4	122.4	121.5	106.8	110.4
2,639,905	1,946,871	1,974,617	1,942,921	2,046,692	23.4	56.8	107.3	74.9	122.1	104.7	75.4	74.8
1,708,352	1,394,371	1,628,538	1,580,079	1,435,252	44.8	83.5	121.9	58.0	114.6	108.7	110.7	124.4
1,406,407	1,894,026	1,526,205	1,550,181	1,418,541	38.3	144.0	130.0	87.2	130.7	151.3	147.4	163.4
1,949,489	1,844,097	1,661,293	2,064,385	1,810,962	51.7	141.3	88.3	88.0	100.9	107.4	98.1	108.2
1,992,413	1,818,879	1,879,881	1,884,373	1,741,679	17.5	53.2	54.6	48.3	62.5	66.3	66.2	65.9
1,920,659	1,865,859	2,072,987	1,452,528	1,454,582	33.5	57.6	90.8	83.2	98.2	92.2	116.4	123.4
2,210,911	1,655,983	1,781,381	1,823,483	1,568,306	37.6	125.6	121.5	94.1	129.9	103.0	105.7	111.2
1,678,792	1,838,511	1,747,170	2,274,633	1,654,590	46.9	200.4	58.2	102.5	130.8	121.4	105.5	130.0
1,587,673	1,769,110	1,468,128	1,422,714	1,282,721	33.2	136.4	134.7	135.6	187.4	195.3	204.8	218.0
1,645,275	1,821,660	1,510,033	1,791,410	1,408,002	115.5	261.0	230.0	71.9	257.4	259.6	231.5	261.1
1,257,460	2,636,047	1,421,242	1,693,890	1,435,679	404.5	275.3	375.5	102.5	237.0	319.0	219.6	215.4
1,675,544	1,582,272	1,455,870	1,864,260	1,766,564	467.5	108.8	165.8	160.1	194.9	185.1	100.2	103.5
1,793,027	1,848,930	1,659,555	1,734,491	1,524,124	111.6	86.1	91.9	96.5	108.9	114.0	106.8	115.4
2,200,605	1,866,089	1,839,464	1,871,693	1,900,654	47.1	66.1	61.8	60.3	77.2	72.5	70.0	71.1
1,952,265	1,741,674	1,929,300	1,796,147	2,213,520	25.4	57.9	48.9	44.5	55.7	47.8	54.6	48.2

Summary for Miss. River Volume at Low Water Reference (LWRP) (ac-ft)Mile-by-mile polygons.

* 1915 RM do not match RM for other years due to cutoffs

RM*	Volume (ac-ft)							
	1915	1948	1963	1975	1988	1994	2004	2013
230	11,141	11,258	10,430	9,791	8,605	10,230		8,761
231	12,666	12,661	10,858	11,324	10,292	11,175	10,513	11,019
232	12,315	13,065	11,353	10,702	10,627	11,262	10,975	11,314
233	12,532	13,470	11,620	10,919	12,340	11,128	10,257	11,248
234	13,044	14,962	11,899	13,267	14,181	11,655	10,226	11,923
235	19,081	26,244	17,430	18,860	16,752	12,282	11,615	12,700
236	11,199	11,844	9,902	9,574	9,141	9,485	9,683	9,337
237		11,669	9,822	8,476	9,478	8,877	8,746	8,609
238		11,697	10,672	10,848	9,279	9,296	8,923	8,730
239		13,112	13,530	13,443	14,168	13,618	15,220	14,428
240		18,164	11,997	12,569	11,860	9,754	10,350	10,077
241		10,963	8,694	9,476	9,544	9,377	10,035	9,627
242		10,979	9,881	8,890	9,109	8,947	9,065	9,117
243		10,981	11,193	10,120	10,409	9,526	10,080	10,028
244		11,083	10,618	9,583	10,420	9,049	9,141	9,372
245		12,264	10,612	8,301	9,882	8,816	10,037	10,025
246		9,023	9,375	5,383	5,308	5,323	6,867	6,352
247		10,076	8,178	6,154	5,030	4,678	6,019	5,653
248		9,560	8,904	8,317	7,090	5,765	6,768	6,962
249		7,969	7,762	8,614	8,676	6,963	8,123	8,241
250		7,486	6,092	4,390	5,095	5,389	6,488	6,060
251		6,150	6,564	4,423	4,190	4,866	5,483	5,812
252		7,809	7,816	7,211	8,724	8,640	8,763	9,107
253		9,937	9,791	11,877	11,330	10,841	10,485	10,510
254	15,148	16,163	13,036	10,650	9,819	10,222	9,977	11,393
255	27,488	19,259	7,798	7,336	8,247	6,746	6,922	6,969
256	10,578	7,641	7,642	7,724	7,855	7,325	6,893	6,840
257	12,902	13,451	11,173	11,470	10,764	11,242	11,394	10,530
258	6,882	7,113	7,676	5,525	6,539	6,657	6,174	5,886
259	9,907	8,553	8,188	7,111	7,547	7,720		6,993
260	10,082	9,071	7,811	8,319	8,435	9,419		10,698
261	11,930	10,576	9,382	10,067	10,356	11,983		12,484
262	11,383	10,352	9,450	9,659	9,811	9,820		9,298
263	11,404	11,302	9,976	10,101	7,682	8,542	7,712	7,889
264	8,960	12,114	8,957	8,554	7,103	6,341	6,278	6,633
265	9,202	11,366	8,474	6,508	7,003	5,735	5,562	5,685
266	9,216	7,804	7,040	6,340	7,244	6,918	6,774	6,351
267	11,761	9,596	8,946	9,109	9,159	8,774	8,625	8,340
268	12,166	11,894	10,534	10,900	11,456	10,308	9,791	10,166
269	12,529	11,857	9,871	11,029	11,455	10,267	10,179	10,028
270	11,914	9,030	7,043	7,897	7,901	6,598	6,473	6,715
271	8,178	5,615	6,742	5,036	7,379	6,663	6,970	6,334

272	6,364	6,143	6,705	4,320	5,915	5,351	6,040	5,638
273	8,878	7,895	7,734	6,545	7,072	6,661	6,705	6,133
274	10,019	9,077	8,599	7,340	7,622	7,664	7,477	7,271
275	9,471	10,145	7,407	6,939	7,377	8,049	7,546	7,101
276	10,137	9,890	8,210	7,238	7,438	7,751	7,086	6,929
277	9,595	10,446	8,334	7,783	8,628	8,332	8,116	7,361
278	8,763	10,807	10,325	9,930	11,030	10,026	9,249	8,889
279	9,344	10,331	8,804	9,022	10,166	9,379	8,922	8,905
280	11,410	10,528	9,897	8,587	10,029	10,395	9,755	9,238
281	14,224	10,775	8,929	8,802	9,430	9,177	8,899	7,571
282	10,010	10,727	9,820	9,468	9,180	9,406	8,549	7,838
283	12,463	12,032	10,930	10,211	9,384	9,792	8,776	8,333
284	9,963	8,639	6,983	7,392	7,966	7,556		6,929
285	9,152	7,986	6,842	7,079	8,377	7,359		6,681
286	8,171	6,676	7,180	6,582	6,685	6,127		5,630
287	9,832	7,470	7,716	7,337	8,256	7,712		6,168
288	10,453	9,327	8,238	7,134	7,827	7,932		6,994
289	11,135	9,920	9,425	8,199	9,240	9,368	8,209	8,519
290	10,802	9,516	7,599	7,218	8,310	8,234	7,032	6,574
291	8,787	8,909	6,906	5,929	7,457	8,101	6,753	6,157
292	8,957	7,371	6,251	5,938	7,428	7,522	6,355	5,175
293	9,333	5,940	4,799	5,579	7,683	6,186	4,768	3,903
294	11,678	6,028	5,689	6,312	6,687	4,238	3,886	3,733
295	9,451	6,944	6,545	6,129	5,840	5,903	4,774	4,410
296	9,566	8,669	7,264	6,221	6,911	7,174	6,114	5,986
297	14,430	9,821	7,550	6,022	8,799	5,378	7,208	7,708
298	14,828	8,164	5,863	2,732	3,856	600	6,593	5,589
299	8,086	5,141	2,364	1,626	1,851	789	6,419	5,643
300	7,551	5,483	4,296	4,601	3,945	4,486	6,793	7,064
301	5,998	5,037	5,253	5,896	6,146	6,459	7,241	7,106
302	6,076	7,261	7,589	11,880	12,263	12,722	9,389	7,584
303	8,460	9,326	9,848	7,628	7,635	6,960	5,444	5,928
304	9,160	8,085	8,680	5,129	6,278	4,346	5,020	4,344
305	11,695		8,686	5,510	4,694	4,413	4,933	3,400
306	12,306	10,100	8,339	6,243	5,522	5,745	6,045	5,892
307	11,237	11,870	8,862	7,534	7,166	7,916	7,714	7,594
308	13,870	11,027	8,397	7,501	7,387	8,929	7,795	7,880
309	14,450	11,468	9,724	9,012	8,684	10,222	8,521	8,054
310	14,280	14,377	12,434	10,508	10,332	11,457	8,946	8,218
311	13,661	13,990	12,111	8,915	7,844	9,737	6,834	6,265
312	18,368	12,490	7,750	5,324	6,553	5,974	4,172	3,964
313	10,827	8,914	6,124	5,224	6,922	6,310	4,960	4,945
314	8,949	7,954	8,615	9,639	9,967	8,377	6,261	6,475
315	10,468	10,251	11,483	15,126	11,369	11,973	8,980	8,319
316	11,411	12,585	9,911	11,771	9,925	11,166	8,914	9,188
317	8,483	12,895	10,762	12,323	11,616	11,917	10,223	9,914
318	9,609	16,675	11,740	14,899	15,059	14,110	12,065	9,822

319	10,324	8,777	8,435	11,259	10,610	11,124	9,961	9,739
320	15,917	8,453	8,250	11,886	10,249	10,752	10,376	10,389
321	17,255	9,440	8,220	11,505	9,570	10,098	10,808	9,898
322	12,363	8,987	6,451	7,190	7,643	6,505	6,923	6,474
323	8,196	7,592	7,234	7,000	7,675	6,141	6,417	6,205
324	6,899	4,623	7,811	6,210	7,792	6,451	7,056	5,695
325	8,902	7,425	6,911	6,791	8,039	6,915	7,487	5,834
326	9,716	9,531	7,804	8,276	10,031	9,040	9,602	8,430
327	9,342	8,461	8,911	10,263	11,573	10,951	10,682	11,872
328	8,992	10,181	11,803	12,534	11,895	12,023	10,307	10,421
329	7,263	10,436	9,641	9,403	10,037	11,110	9,284	8,129
330	7,278	11,764	9,371	10,822	10,859	12,155	9,042	8,806
331	8,695	7,896	6,849	7,830	7,928	8,499	7,465	5,517
332	10,993	8,992	8,638	10,210	10,610	9,680	8,796	7,948
333	11,743	9,532	9,001	11,304	11,469	11,465	9,726	9,567
334	12,412	9,789	9,378	11,748	10,541	11,015	9,634	10,112
335	14,367	9,731	9,451	9,657	7,414	8,135	8,156	8,065
336	10,409	9,112	8,260	8,365	7,258	7,213	7,545	7,413
337	9,232	6,347	8,740	7,973	6,555	5,443	6,828	7,129
338	9,289	7,650	8,536	4,916	5,000	3,587	4,424	6,139
339	12,587	5,700	8,818	7,555	6,973	4,191	6,560	6,417
340	11,967	7,831	8,621	10,549	9,011	3,171	8,327	7,543
341	7,291	11,617	9,951	13,487	10,700	9,668	9,650	9,598
342	12,783	8,877	9,696	12,390	11,120	10,649	10,315	11,619
343	11,439	12,162	11,258	13,543	14,007	13,972	11,989	13,467
344	11,145	10,548	12,629	10,206	8,137	6,949	7,808	7,410
345	11,180	7,792	8,822	11,551	7,627	8,493	7,923	7,997
346	10,962	9,137	9,311	8,032	7,067	7,857	7,595	7,301
347	10,182	7,282	8,181	5,700	4,976	4,962	6,252	5,446
348	9,163	8,889	6,285	6,014	5,595	4,730	5,744	6,046
349	8,598	6,021	8,029	7,034	6,218	6,273	5,844	7,367
350	8,850	7,768	9,051	7,243	7,245	6,674	7,692	6,882
351	8,449	8,722	8,098	4,681	6,027	4,857	6,445	5,279
352	9,118	10,099	7,614	6,268	7,447	6,515	7,846	6,397
353	10,317	8,261	8,335	7,886	8,737	7,513	8,379	7,764
354	11,648	7,994	9,193	8,914	10,075	10,018	9,234	10,409
355	11,995	7,088	9,353	12,057	9,706	11,366	9,308	9,985
356	11,561	5,985	10,507	8,089	6,897	8,170	7,113	7,832
357	8,911	4,251	10,258	3,390	7,909	5,847	9,133	7,021
358	7,478	4,809	5,423	5,929	7,411	5,764	6,147	4,642
359	8,371	7,565	7,056		10,084	9,172	8,198	8,178
360	8,231	9,065	8,686		10,515	9,438	8,673	8,550
361	8,651	10,190	9,140		10,899	10,398	9,267	10,052
362	7,354	10,200	9,731		10,913	10,957	9,377	10,343
363	8,215	9,725	9,742	11,387	10,189	9,691	8,486	9,710
364	8,197	10,193	10,712	13,559	10,807	10,891	8,904	9,722
365	8,439	11,282	11,145	14,279	10,965	10,491	9,879	10,408

366	6,986	10,286	10,173	11,790	9,927	9,429	9,832	10,138
367	5,695	8,864	8,203	10,528	8,203	8,293	7,736	8,770
368	5,749	7,636	7,364	8,566	8,219	7,873	7,842	8,584
369	7,524	6,406	6,760	8,208	9,505	10,021	8,731	9,283
370	9,863	7,553	8,210	9,227	10,242	11,726	10,005	11,047
371	11,039	7,066	8,356	11,157	9,038	9,544	8,873	9,527
372	13,187	7,662	8,249	11,263	8,233	9,220	7,313	7,902
373	11,271	8,526	9,407	11,310	7,711	9,166	5,858	5,913
374	10,951	8,662	7,428	8,501	7,113	7,209	6,084	6,272
375	11,283	5,615	7,315	6,592	7,439	6,832	6,830	6,814
376	12,255	6,154	6,198	4,706	7,127	5,855	5,733	6,460
377	11,355	6,327	4,837	4,770	6,739	5,068	5,283	5,674
378	10,963	7,321	4,912	3,833	6,192	4,606	5,559	5,290
379	10,023	6,982	5,942	4,252	6,443	5,275	6,537	5,422
380	9,604	6,238	8,102	7,632	8,144	8,010	7,850	6,816
381	10,699	7,741	8,331	10,143	9,418	10,970	9,004	9,038
382	8,370	9,907	8,182	9,661	8,833	9,466	8,519	9,263
383	7,150	7,141	8,022	8,874	7,592	7,732	8,135	7,752
384	6,789	6,463	7,322	8,048	8,083	6,449	6,900	5,971
385	6,945	7,414	7,148	6,897	7,759	6,725	6,691	5,887
386	7,541	8,019	6,998	6,120	7,352	7,234	5,891	6,107
387	9,021	5,448	6,188		8,306	5,918	6,098	5,562
388	12,256	4,541	6,079		6,960	4,390	7,091	5,618
389	11,691	6,235	4,080	9,298	6,926	7,897	8,743	8,356
390	11,756	6,158	7,139	9,645	7,813	7,968	7,513	7,729
391	12,399	5,795	7,618	5,911	7,194	6,038	7,350	7,419
392	12,088	6,506	6,724	6,499	6,341	4,915	6,311	5,879
393	11,914	4,781	6,393	7,594	6,953	6,795	6,375	6,318
394	10,872	6,886	7,249	7,990	7,572	6,460	7,088	7,229
395	12,329	8,665	8,350	9,530	7,900	8,443	8,495	7,327
396	13,639	9,970	10,850	13,243	9,537	10,684	10,154	11,636
397	12,773	9,315	10,887	10,381	8,246	8,926	8,540	8,874
398	11,693	10,209	10,696	12,672	9,151	9,218	8,612	8,508
399	9,335	8,858	8,872	11,178	5,082	8,529	7,138	7,624
400	8,447	7,865	8,362	8,676	6,690	7,445	6,684	6,508
401	9,344	7,214	8,950	7,108	6,398	6,037	6,255	6,793
402	11,171	8,397	8,079	6,918	5,391	5,867	6,520	7,013
403	10,893	7,110	8,175	7,178	4,094	5,471	6,828	6,604
404	11,091	8,617	8,531	9,108	5,992	7,301	7,766	7,681
405	12,566	8,567	8,803	8,226	7,652	10,003	8,095	7,813
406	11,829	8,784	8,827	8,284	10,615	10,839	10,002	10,238
407	9,249	7,089	9,064	9,118	8,580	9,222	9,544	10,177
408	7,690	3,783	9,351	7,741	9,629	7,321	8,757	9,203
409	8,524	2,682	6,498	6,653	7,589	5,282	6,756	6,244
410	7,784	5,675	8,907	8,093	8,780	6,003	7,786	7,367
411	8,596	6,888	8,692	8,059	8,896	8,416	8,516	8,324
412	9,881	8,729	9,092	9,324	9,659	11,647	9,914	11,211

413	12,150	9,356	8,633	8,622	9,859	9,340	10,900	10,204
414	12,860	3,908	8,745	5,509	4,860	7,546	8,092	6,825
415	15,649	3,926	8,440	5,244	6,276	7,126	6,059	6,172
416	13,723	2,882	8,942	4,848	5,438	4,508	4,724	4,593
417	10,878	4,686	11,034	8,982	8,429	8,186	9,351	8,949
418	12,028	6,682	6,593	6,006	6,855	7,045	7,212	6,912
419	12,004	6,830	7,306	7,188	6,978	7,982	7,387	6,329
420	11,721	7,244	6,734	10,022	7,728	8,889	7,847	7,837
421	12,517	8,856	6,550	8,401	7,917	8,028	7,193	7,217
422	11,977	6,265	5,900	7,025	7,266	4,960	6,577	5,708
423	10,769	5,416	6,379	7,118	6,473	4,719	6,076	5,094
424	10,103	6,695	7,314	8,963	7,173	7,094	7,330	6,833
425	11,983	7,266	7,063	8,248	7,454	8,339	6,847	6,734
426	10,001	6,076	7,296	8,204	6,794	7,080	6,521	7,780
427	12,252	5,381	8,506	7,263	6,076	7,274	7,070	8,728
428	12,473	6,719	8,630	4,161	6,070	4,279	7,241	7,430
429	9,537	6,937	5,780		4,319	2,144	5,761	6,060
430	9,707	5,588	3,760		3,510	1,276	4,739	3,367
431	12,264	2,647	4,087		5,886	3,723	6,763	4,938
432	12,608	10,491	5,806	5,951	6,911	5,515	7,175	6,248
433	10,843	12,132	8,833	8,956	8,230	7,992	7,677	7,087
434	11,356	10,451	10,575	10,992	9,274	9,834	9,023	9,864
435	12,201	8,704	9,604	9,547	8,184	9,188	8,136	9,018

Summary for Miss. River Volume at Bankfull Reference (LWRP+25) (ac-ft)Mile-by-mile polygons.

* 1915 RM do not match RM for other years due to cutoffs

RM*	Volume (ac-ft)							
	1915	1948	1963	1975	1988	1994	2004	2013
230	19,253	20,183	19,416	18,879	16,887	19,329	15,545	16,116
231	19,897	20,548	18,531	19,300	17,368	19,092	18,264	18,786
232	18,632	20,393	18,619	18,252	17,798	18,737	18,569	18,918
233	19,209	20,765	18,711	18,323	19,268	18,417	17,338	18,355
234	19,800	22,101	18,627	20,298	20,612	18,607	17,070	18,765
235	25,595	33,552	24,596	26,333	24,107	19,907	19,282	20,395
236	17,588	19,244	17,214	17,108	16,085	17,104	17,371	17,027
237		18,124	16,257	15,099	15,768	15,555	15,519	15,391
238		18,235	17,394	17,805	15,907	16,416	16,251	16,099
239		18,698	19,801	19,965	20,375	20,204	22,068	21,252
240		25,936	18,091	19,317	18,998	16,832	17,275	16,990
241		18,933	15,289	16,660	16,251	16,425	16,680	16,286
242		17,491	16,202	15,315	14,327	14,937	15,126	15,177
243		16,008	16,753	16,720	16,204	15,715	16,581	16,517
244		16,859	17,326	16,707	17,257	16,448	16,642	16,907
245		19,790	19,073	15,851	17,146	16,693	17,982	17,986
246		16,635	16,827	10,829	10,879	11,732	13,400	12,909
247		17,598	15,156	12,416	11,174	10,571	12,735	12,230
248		15,146	15,128	14,670	13,751	11,950	13,318	13,533
249		12,877	13,503	14,032	14,691	12,529	13,838	14,069
250		13,949	12,878	10,445	11,270	11,611	12,309	12,001
251		13,702	14,125	10,224	11,003	10,555	11,436	11,905
252		17,347	16,836	15,501	17,534	16,094	16,052	16,355
253		16,027	16,575	18,291	17,102	17,563	17,412	17,480
254		22,502	19,186	17,194	15,941	17,169	17,416	18,804
255	37,594	25,814	12,775	13,392	14,853	12,489	12,944	12,999
256	18,650	13,276	13,731	14,787	15,023	14,392	13,986	13,675
257	19,797	19,812	17,741	18,012	17,805	17,873	18,173	17,193
258	12,792	15,206	15,812	13,907	14,733	14,899	15,061	14,420
259	17,382	17,166	16,616	15,758	16,112	16,646		16,102
260	17,117	16,738	15,493	16,073	16,264	17,053		18,414
261	19,405	18,646	17,346	18,091	18,023	19,769		19,984
262	16,304	16,148	15,218	15,407	15,018	15,377		14,864
263	16,257	16,999	15,657	16,317	12,356	15,390	14,539	14,906
264	16,783	20,046	16,713	16,602	14,091	14,579	14,594	14,948
265	18,766	20,645	17,720	15,765	16,271	14,983	14,811	14,929
266	17,094	15,161	14,542	14,018	15,104	14,824	14,667	14,246
267	19,354	16,642	16,184	16,808	16,713	16,733	16,609	16,328
268	18,333	18,500	17,085	17,348	17,067	16,766	16,434	16,859
269	18,383	18,134	15,975	17,338	17,786	16,583	16,753	16,686
270	17,554	13,652	12,792	13,454	14,098	12,237	12,244	12,537
271	12,693	11,798	13,198	11,656	14,930	13,501	14,033	13,459

272	11,846	13,136	14,212	11,711	13,251	12,681	13,502	13,074
273	17,137	15,631	15,625	14,291	14,031	13,702	13,683	13,014
274	16,669	15,155	14,971	13,526	12,714	13,950	13,928	13,832
275	15,321	17,129	14,209	14,307	13,559	15,720	15,281	14,877
276	16,227	16,859	15,436	14,762	14,513	15,369	14,646	14,494
277	14,681	17,165	15,154	14,891	14,971	15,475	15,244	14,452
278	13,186	16,794	16,134	15,726	15,675	15,608	14,928	14,558
279	13,649	15,998	15,044	15,561	16,393	15,942	15,675	15,650
280	18,454	19,118	17,168	15,699	16,150	17,332	16,379	15,724
281	22,130	18,541	15,247	14,999	14,816	15,288	15,153	13,828
282	15,158	17,151	16,744	16,540	15,062	16,513	15,797	15,153
283	18,276	18,226	17,458	17,008	15,756	16,942	16,007	15,590
284	15,160	13,740	12,559	12,988	13,995	13,452		12,937
285	17,058	14,437	13,428	13,967	16,080	14,560		13,934
286	17,898	14,561	15,238	14,741	14,638	14,274		13,749
287	18,861	14,724	15,088	14,717	15,737	15,187		13,664
288	18,819	15,544	15,687	14,615	15,081	15,502	12,574	14,611
289	17,826	15,514	16,206	15,120	15,988	16,318	15,247	15,510
290	15,686	14,726	13,960	14,202	14,896	15,659	14,484	13,801
291	13,087	14,970	13,365	12,472	13,993	14,932	13,879	13,128
292	14,748	15,269	13,333	12,840	14,193	14,317	13,406	12,219
293	17,114	16,337	12,559	13,590	14,492	12,654	11,447	10,690
294	21,138	15,021	12,939	14,108	12,979	10,483	11,511	11,503
295	17,672	16,382	13,931	13,970	11,487	12,777	12,460	12,093
296	17,328	17,188	13,964	12,993	12,647	14,238	13,254	13,097
297	21,734	15,894	13,679	12,577	15,748	12,967	14,947	15,466
298	24,280	16,506	14,290	10,852	12,551	5,234	14,158	13,278
299	17,304	12,709	9,777	9,010	9,463	6,099	13,727	12,787
300	14,984	12,197	11,144	11,882	10,973	12,078	14,413	14,368
301	13,467	10,340	10,934	12,437	12,577	13,827	14,580	14,170
302	14,334	13,006	13,711	18,430	18,912	19,435	16,057	14,156
303	15,095	16,963	15,673	13,467	14,629	12,728	10,984	11,220
304	15,340	15,045	15,624	11,884	13,382	11,009	11,061	10,651
305	17,978		18,006	14,883	12,346	13,710	14,107	12,750
306	18,416	18,021	16,662	14,724	13,970	14,322	14,628	14,474
307	19,664	19,356	16,481	14,907	14,404	15,658	15,435	15,321
308	23,313	17,600	15,326	14,154	13,743	15,788	14,339	14,351
309	21,402	17,751	16,771	16,184	14,599	17,171	15,413	14,861
310	20,265	21,256	19,656	17,188	17,088	19,410	16,868	15,878
311	20,735	21,326	20,335	17,019	15,606	17,239	14,401	13,835
312	28,095	21,327	15,959	13,988	15,622	13,544	11,778	11,588
313	19,208	17,839	14,355	13,814	15,029	13,222	11,948	11,947
314	17,326	16,799	16,803	17,072	16,443	14,180	11,991	12,349
315	19,107	17,688	18,272	21,588	16,075	17,724	14,616	14,020
316	18,084	18,451	16,109	17,851	14,431	17,352	14,993	15,115
317	12,654	19,090	17,592	19,289	17,212	19,110	17,464	16,803
318	15,320	24,618	19,275	22,461	21,919	21,552	19,351	17,018

319	17,457	14,812	15,359	18,132	17,229	18,083	16,903	16,689
320	27,391	15,241	15,671	19,262	17,369	18,175	17,831	17,806
321	27,633	16,449	15,693	18,795	16,468	17,722	18,297	17,389
322	18,929	14,833	12,358	12,888	13,299	12,422	12,646	12,089
323	14,288	13,249	13,387	13,379	12,943	12,301	12,496	12,461
324	12,877	10,275	14,504	11,474	14,864	13,299	14,177	12,918
325	15,570	14,744	14,404	14,095	16,093	15,128	15,709	14,014
326	16,215	16,920	14,822	15,496	17,422	16,402	16,945	15,562
327	15,882	14,111	14,879	16,189	18,001	17,229	16,893	17,983
328	14,754	15,891	17,594	18,090	17,819	17,793	16,022	16,292
329	10,943	17,480	17,093	15,447	17,258	18,595	16,366	15,334
330	11,780	21,745	18,890	20,792	20,140	21,372	18,167	18,127
331	14,366	17,731	16,374	17,861	16,030	17,274	16,598	14,986
332	18,528	18,031	17,483	19,994	20,542	19,465	18,781	18,016
333	19,694	17,091	17,084	19,199	19,860	19,363	18,000	17,825
334	20,653	18,163	17,886	20,052	18,298	19,886	18,569	18,421
335	24,395	17,848	17,256	17,861	16,590	16,977	16,307	15,933
336	17,625	15,961	16,029	15,902	17,286	16,679	16,249	15,768
337	16,106	12,922	17,028	15,917	15,197	13,660	15,615	15,711
338	15,146	16,124	15,703	12,087	12,177	10,706	11,601	13,316
339	20,000	13,349	16,928	15,135	15,106	12,143	14,717	14,574
340	19,291	16,256	16,699	18,755	17,295	11,454	16,590	15,827
341	13,157	19,012	17,476	21,455	19,196	18,316	17,830	18,262
342	21,313	14,180	15,494	19,265	18,747	17,968	17,859	19,154
343	18,510	18,091	18,575	20,753	21,271	20,887	18,751	20,126
344	19,024	16,831	19,398	17,023	15,705	14,246	14,322	13,866
345	19,549	14,869	14,895	18,189	16,654	16,986	16,197	15,790
346	19,042	16,532	17,190	15,401	14,338	14,626	15,202	15,224
347	17,202	14,865	16,316	9,860	10,984	10,851	12,683	11,819
348	16,203	17,134	14,157	11,307	11,665	9,419	11,384	12,479
349	15,832	14,016	17,100	13,279	13,087	12,552	13,101	15,851
350	16,569	16,710	18,527	16,244	16,385	15,543	16,792	16,352
351	16,139	16,131	17,950	12,887	15,106	13,893	15,500	14,328
352	17,577	18,476	16,339	15,531	17,169	16,191	17,575	16,071
353	18,726	16,650	16,559	16,682	17,561	16,078	16,976	16,191
354	17,703	15,373	17,176	16,619	17,894	17,435	16,359	17,665
355	17,939	14,297	16,857	18,725	16,004	17,916	15,927	16,685
356	18,322	13,688	17,821	14,621	15,095	16,298	15,312	15,942
357	16,163	14,086	21,540	12,111	17,849	15,729	19,003	16,939
358	16,467	15,129	13,918	13,709	15,191	13,544	13,927	12,422
359	16,668	15,611	16,087	15,661	19,386	18,590	17,607	17,574
360	17,299	17,617	18,319		20,493	19,347	18,622	18,438
361	17,635	18,358	18,188		20,126	19,448	18,329	19,157
362	16,066	16,856	17,318	14,798	18,661	18,728	17,101	18,049
363	17,086	16,588	17,579	19,236	17,913	17,584	16,451	17,544
364	17,156	18,455	19,318	22,166	19,483	19,569	17,598	18,426
365	17,280	17,540	17,263	20,746	17,643	17,013	16,682	17,199

366	15,797	15,361	15,960	17,690	16,866	16,475	17,014	17,393
367	14,727	16,300	16,525	19,368	17,484	17,623	17,221	18,110
368	13,944	16,451	16,147	17,653	17,305	16,959	16,929	17,670
369	14,561	15,078	14,266	16,917	18,199	18,646	17,371	17,859
370	18,585	16,620	15,389	17,352	17,890	18,970	16,943	17,943
371	19,298	14,878	15,754	18,568	15,742	16,059	15,359	16,146
372	19,364	15,512	16,024	19,269	16,391	17,336	15,318	15,921
373	17,095	17,426	19,703	21,113	18,101	19,541	16,273	16,338
374	17,161	16,771	15,517	17,127	16,816	16,854	15,750	16,023
375	17,716	13,700	15,116	14,723	16,124	15,157	15,311	15,435
376	20,339	14,268	14,110		13,826	12,451	12,877	13,953
377	20,081	13,762	12,445	11,412	13,970	12,165	13,207	12,513
378	18,605	14,581	12,332	10,804	14,481	12,927	13,777	13,252
379	17,526	15,066	15,010	11,877	15,355	14,171	15,418	14,359
380	16,175	15,082	16,765	16,193	17,092	16,695	16,803	15,817
381	16,509	14,509	15,058	17,168	16,392	17,852	16,052	16,122
382	14,884	16,422	14,058	15,209	15,393	16,245	14,955	15,709
383	14,202	14,268	15,872	13,900	14,086	13,383	14,054	13,036
384	13,006	14,593	15,479	16,961	16,821	14,787	15,374	14,296
385	13,046	15,362	15,098	15,079	15,973	14,977	14,944	14,131
386	13,253	16,017	14,576	12,581	15,946	15,841	14,498	14,709
387	16,308	11,592	13,279		16,925	14,567	14,727	14,176
388	19,982	11,429	15,445	10,348	16,401	13,806	16,531	15,053
389	17,464	12,668	11,151	18,411	16,011	17,082	17,936	17,552
390	17,589	14,408	15,804	18,606	16,621	16,594	15,970	16,148
391	18,973	13,136	16,147	12,865	13,416	12,531	13,444	13,846
392	18,669	13,317	15,335	14,195	14,015	12,466	13,672	13,439
393	20,161	10,541	14,218	16,370	15,692	15,414	14,998	14,937
394	18,588	14,677	16,455	17,346	16,944	15,856	16,529	16,669
395	21,115	17,313	17,311	17,624	16,371	16,819	16,918	15,781
396	22,515	17,951	18,691	20,594	16,323	17,777	16,837	18,446
397	21,579	16,601	17,656	17,584	16,262	16,029	15,922	15,567
398	19,469	17,197	18,247	20,587	17,182	16,862	16,156	16,242
399	16,861	16,881	17,180	19,477	13,053	16,826	15,444	15,945
400	16,986	15,420	15,954	16,279	14,292	14,986	14,287	14,109
401	18,262	14,231	16,928	15,151	14,477	13,779	14,124	14,856
402	20,245	15,325	16,015	14,730	13,374	13,788	14,570	15,108
403	19,984	13,600	15,897	15,136	12,001	13,391	14,788	14,587
404	20,181	16,397	17,024	17,800	14,692	15,750	16,461	16,368
405	21,079	15,799	16,934	16,756	16,179	18,410	16,601	16,324
406	18,349	16,466	17,142	16,662	19,304	18,501	18,522	18,719
407	14,127	15,274	17,077	15,824	16,993	16,961	17,233	17,626
408	12,414	13,966	18,133	14,556	19,450	16,158	17,683	18,341
409	14,067	11,282	13,803	15,533	16,717	14,262	15,801	15,280
410	14,074	15,274	18,420	18,326	19,574	16,821	18,617	18,184
411	15,357	15,078	15,860	14,099	16,200	15,763	15,885	15,669
412	17,843	15,708	16,452	16,081	16,057	17,920	16,334	17,223

413	17,928	15,368	16,432	15,963	17,564	17,163	18,199	16,614
414	17,882	10,683	18,414	13,646	13,141	15,991	16,237	14,599
415	21,620	8,370	17,161	11,340	13,041	13,876	12,583	12,533
416	20,803	8,241	18,933	11,235	11,147	9,269	8,945	8,820
417	17,586	13,714	22,265	14,931	15,680	15,835	16,213	15,494
418	19,355	13,191	13,129	11,504	13,745	13,096	13,001	12,299
419	17,667	12,564	15,868	15,661	15,102	15,970	15,435	13,598
420	17,361	12,874	14,178	17,492	14,978	15,791	14,842	14,933
421	19,630	16,475	14,713	15,471	15,003	16,480	15,616	15,674
422	18,781	14,887	14,215	15,109	16,328	14,263	15,830	14,856
423	16,498	12,372	14,924	15,784	15,105	13,319	14,725	13,708
424	15,232	13,845	14,923	16,897	15,556	15,590	15,833	15,273
425	20,504	14,528	15,663	17,314	16,532	17,432	15,219	14,773
426	18,447	14,252	15,691	17,032	15,624	15,878	15,143	16,025
427	19,512	12,893	15,955	15,655	14,475	15,689	15,481	15,794
428	18,033	14,047	17,294	13,515	15,506	13,401	16,072	15,464
429	15,183	15,099	13,718		11,639	9,234	13,352	12,683
430	16,311	14,370	10,880		10,194	9,607	13,381	11,724
431	19,725	11,520	10,898		14,847	12,670	15,721	13,897
432	18,687	19,658	14,635	15,340	16,237	14,807	16,390	15,500
433	15,883	21,406	18,260	18,527	17,726	17,197	17,070	16,470
434	17,556	17,965	18,185	19,219	17,427	17,920	17,391	18,351
435	19,269	15,018	15,576	15,854	14,801	15,912	14,787	15,548

Appendix B: Atchafalaya River Geometric Data Tables

Summary of Geometric Data Parameters for Atchafalaya River cross sections at Low Water Reference

RM	Cross sectional area (ft ²)					Width (ft)					Hydraulic Depth (ft)					Conveyance (AD ^{2/3})						
	XXXX	1976	1989	1998	2010	2019	XXXX	1976	1989	1998	2010	2019	XXXX	1976	1989	1998	2010	2019				
0	0	35119		38005	45308	52861	0	1350		1725	1550	1550	#DIV/0!	26.0		22.0	29.2	34.1		308325		298684
1.1	0	44536		40697	42451	46334	0	1200		1325	1350	1375	#DIV/0!	37.1		30.7	31.4	33.7		495517		399138
2	0	40494		49053	47695	55048	0	1525		1650	1700	1725	#DIV/0!	26.6		29.7	28.1	31.9		360413		470743
3	0	60965	47296	51558	55573	60082	0	1650	1350	1300	1350	1350	#DIV/0!	36.9	35.0	39.7	41.2	44.5		676309	506392	599595
4.1	0	46061	43346	48874	44679	50017	0	1300	1275	1250	1250	1250	#DIV/0!	35.4	34.0	39.1	35.7	40.0		496894	454899	563010
5	0	41713	36996	48172	50154	51202	0	1325	1150	1175	1175	1175	#DIV/0!	31.5	32.2	41.0	42.7	43.6		415894	374223	572754
6	0	45412	47471	47593	51426	51904	0	1375	1275	1300	1350	1375	#DIV/0!	33.0	37.2	36.6	38.1	37.7		467463	529311	524745
7	0	39079	43354	43424	46711	46839	0	1750	1625	1650	1675	1675	#DIV/0!	22.3	26.7	26.3	27.9	28.0		309891	387087	384199
8	0	38832	39235	39780	42100	42773	0	1675	1800	1825	1850	1875	#DIV/0!	23.2	21.8	21.8	22.8	22.8		315721	306148	310406
9	0	38909	39177	39775	45568	44262	0	1925	1825	1825	1900	1900	#DIV/0!	20.2	21.5	21.9	24.0	23.3		288708	302608	312948
10	0	35964	34209	47543	44921	52986	0	1875	2275	2350	1550	1600	#DIV/0!	19.2	15.0	20.2	29.0	33.1		257696	208405	352996
11	0	41023	36331	40830	41883	42686	0	1600	1725	1750	1850	1850	#DIV/0!	25.6	21.1	23.3	22.6	23.1		356689	277082	333382
12	0	37542	37436	40756	43157	42365	0	1625	1900	1975	2075	2100	#DIV/0!	23.1	19.7	20.6	20.8	20.2		304532	273094	306628
13	0		39068	41873	42567	47215	0		1900	1650	1800	1825	#DIV/0!		20.6	25.4	23.6	25.9			293228	361606
14	0	60901	53640	50108	42429	45897	0	950	1075	1050	1050	1125	#DIV/0!	64.1	49.9	47.7	40.4	40.8		975501	727005	659263
15	0	80409	54725	50071	53885	60918	0	1400	1050	1225	1150	1100	#DIV/0!	57.4	52.1	40.9	46.9	55.4		1196980	763569	594131
16	0	41248	40798	39157	44806	45290	0	1700	1600	1600	1675	1675	#DIV/0!	24.3	25.5	24.5	26.8	27.0		345711	353435	330067
17	0	31855	45097	46212	48101	52450	0	1750	2275	2350	2175	2375	#DIV/0!	18.2	19.8	19.7	22.1	22.1		220430	330319	336679
18	0	98440	71380	64703	70392	63015	0	1850	1525	1500	1400	1450	#DIV/0!	53.2	46.8	43.1	50.3	43.5		1392648	927069	795825
19	0	46128	52955	60846	59399	66196	0	1650	1600	1650	1650	1700	#DIV/0!	28.0	33.1	36.9	36.0	38.9		424891	545876	674114
20	0	55774	55853	48093	50610	50125	0	1500	1750	1875	1875	1925	#DIV/0!	37.2	31.9	25.6	27.0	26.0		621330	561985	418279
21	0	46354	47491	46308	46722	46609	0	1375	1450	1500	1525	1525	#DIV/0!	33.7	32.8	30.9	30.6	30.6		483734	486151	455716
22	0	40280	43693	44154	47058	45232	0	1150	1150	1150	1200	1225	#DIV/0!	35.0	38.0	38.4	39.2	36.9		431205	493806	502526
23	0	37625	45581	51149	48392	45992	0	1300	1375	1400	1425	1425	#DIV/0!	28.9	33.1	36.5	34.0	32.3		354676	470367	563179
24	0	50350	51450	53179	58125	61181	0	1225	1300	1350	1450	1450	#DIV/0!	41.1	39.6	39.4	40.1	42.2		599671	597505	615675
25	0	56455	53579	46808	51346	58926	0	1450	1375	1250	1350	1375	#DIV/0!	38.9	39.0	37.4	38.0	42.9		648523	615831	523917
26	0	61031	53725	54990	50336	50705	0	1225	1125	1100	1150	1175	#DIV/0!	49.8	47.8	50.0	43.8	43.2		826334	707183	746237
27	0	55910	52861	47319	51808	50035	0	1150	1325	1450	1475	1475	#DIV/0!	48.6	39.9	32.6	35.1	33.9		744762	617183	483218
28	0	45572	49622	47853	50418	51024	0	1100	1075	1100	1125	1125	#DIV/0!	41.4	46.2	43.5	44.8	45.4		545632	638538	591903
29	0	50220	49955	55447	51090	51510	0	1250	1200	1150	1175	1175	#DIV/0!	40.2	41.6	48.2	43.5	43.8		589098	600042	734518
30.1	0	56335	54294	52648	56788	56749	0	1150	1325	1325	1300	1325	#DIV/0!	49.0	41.0	39.7	43.7	42.8		754221	645328	613037
31.1	0	69456	96249	95128	72017	71220	0	1275	1325	1450	1525	1450	#DIV/0!	54.5	72.6	65.6	47.2	49.1		998111	1675651	1547394
32	0	58895	64617	49122	57601	57414	0	1200	1150	1250	1275	1150	#DIV/0!	49.1	56.2	39.3	45.2	49.9		789487	947926	567781
33.2	0	44750	50784	48113	53002	55783	0	1200	1425	1550	1525	1550	#DIV/0!	37.3	35.6	31.0	34.8	36.0		499499	549960	475209
34.1	0	53986	52923	48397	53710	56967	0	1275	1325	1350	1350	1350	#DIV/0!	42.3	39.9	35.8	39.8	42.2		655832	618400	526187
35	0	70358	58110	60025	60416	62529	0	1250	1050	1025	1050	1050	#DIV/0!	56.3	55.3	58.6	57.5	59.6		1033342	843902	905192
36.1	0	45925	65190	62425	66866	66058	0	1125	1250	1250	1250	1275	#DIV/0!	40.8	52.2	49.9	53.5	51.8		544478	909980	846553
37.2	0	56105	55712	55537	57878	60696	0	1250	1150	1150	1200	1175	#DIV/0!	44.9	48.4	48.3	48.2	51.7		708591	740368	736489
38	0	49411	53086	49813	50286	50583	0	1075	1050	1050	1050	1075	#DIV/0!	46.0	50.6	47.4	47.9	47.1		634008	725831	652807
39.2	0	60438	60648	59285	62854	65111	0	1100	1250	1325	1350	1350	#DIV/0!	54.9	48.5	44.7	46.6	48.2		873495	806788	747188
40	0	54505	62163	60430	63320	64984	0	1100	1275	1300	1325	1350	#DIV/0!	49.6	48.8	46.5	47.8	48.1		735301	829610	781259
41	0	56051	55691	50322	55661	56762	0	1350	1200	1225	1300	1275	#DIV/0!	41.5	46.4	41.1	42.8	44.5		672063	719199	599109
42	0	53258	60137	59756	60860	63019	0	1175	1225	1225	1250	1275	#DIV/0!	45.3	49.1	48.8	48.7	49.4		677032	806269	797763
43.2	0		65931	61032	61764	61731	0		1325	1300	1400	1425	#DIV/0!		49.8	46.9	44.1	43.3			891941	794262
44	0	60940	70013	69939	73091	74746	0	1250	1450	1500	1525	1525	#DIV/0!	48.8	48.3	46.6	47.9	49.0		813262	928357	906024
45	0	44343	66069	63468	62206	64376	0	1550	1650	1700	1650	1600	#DIV/0!	28.6	40.0	37.3	37.7	40.2		414775	773278	708606
45.9	0	73326	65482	66212	69467	65739	0	1200	1350	1275	1300	1250	#DIV/0!	61.1	48.5	51.9	53.4	52.6		1137554	870932	921629
47	0	61446	62616	59716	62408	65975	0	1325	1350	1375	1450	1425	#DIV/0!	46.4	46.4	43.4	43.0	46.3		793131	808334	737818
48	0	60510	60323	57699	59931	63212	0	1400	1425	1425	1475	1575	#DIV/0!	43.2	42.3	40.5	40.6	40.1		745235	732709	680360
49	0	55565	63097	57486	60445	60764	0	1350	1650	1825	1850	1850	#DIV/0!	41.2	38.2	31.5	32.7	32.8		662389	716177	573367
50	0	90997	82601	70188	71171	73433	0	1450	1225	1575	1675	1625	#DIV/0!	62.8	67.4	44.6	42.5	45.2		1437037	1368420	882237
51	0	65828		61709	78371	84977	0	1200		1575	1575	1600	#DIV/0!	54.9		39.2	49.8	53.1		950382		711863
52	0	69969	68595	57808	61277	66295	0	1225	1250	1325	1350	1300	#DIV/0!	57.1	54.9	43.6	45.4	51.0		1037726	990569	716420
53	0	58698	64821	67246	65032	73011	0	1375	1575	1625	1725	1750	#DIV/0!	42.7	41.2	41.4	37.7	41.7		716964	772692	804528
54	0	62265	67868	62812	66336	62999	0	1275	1300	1300	1275	1300	#DIV/0!	48.8	52.2	48.3	52.0	48.5		831891	948011	833261
55	0	91322	79178	61532	62776	69090	0	1525	1700	1725	1725	1700	#DIV/0!	59.9	46.6	35.7	36.4	40.6		1397805	1024960	666763
56	0	51299	76389	64743	68154	68125	0	1050	1350	1325	1400	1425	#DIV/0!	48.9	56.6	48.9	48.7	47.8		685570	1125882	865315
57	0	51558	56202	57106	58647	60109	0	900	1000	1025	1150	1150	#DIV/0!	57.3	56.2	55.7	51.0	52.3		76616		

79	0	44055	54265	60203	58571	0	950	1075	1075	1100	#DIV/0!	46.4	50.5	56.0	53.2	568647	741195
80	0	46753	59484	64654	65314	0	975	1300	1075	1125	#DIV/0!	48.0	45.8	60.1	58.1	617089	760976
81	0	46719	58626	62397	64880	0	1475	1200	1200	1250	#DIV/0!	31.7	48.9	52.0	51.9	467689	783476
82	0	44318	56069	59259	59621	0	1150	1400	1425	1500	#DIV/0!	38.5	40.0	41.6	39.7	505623	656334
83	0	46419	57423	60847	62796	0	1300	1300	1275	1300	#DIV/0!	35.7	44.2	47.7	48.3	503339	717549
84	0	44472	54840	59328	58985	0	1000	1100	1175	1225	#DIV/0!	44.5	49.9	50.5	48.2	558218	742838
85	0	44434	53397	57984	58435	0	1200	1225	1225	1300	#DIV/0!	37.0	43.6	47.3	45.0	493629	661369
86	0	43348	53622	58837	60557	0	1100	1100	1075	1125	#DIV/0!	39.4	48.7	54.7	53.8	501989	715552
87	0	47510	53457	55704	54772	0	1125	1175	1150	1200	#DIV/0!	42.2	45.5	48.4	45.6	576156	681271
88	0	45789	53545	57424	58190	0	1100	1150	1150	1175	#DIV/0!	41.6	46.6	49.9	49.5	549973	693007
89	0	42784	53287	57729	60409	0	1025	1225	1275	1325	#DIV/0!	41.7	43.5	45.3	45.6	514812	659086
90	0	43123	52275	51722	57651	0	1075	1150	1150	1175	#DIV/0!	40.1	45.5	45.0	49.1	505327	665825
91	0	40690	51510	52233	55628	0	1150	1150	1175	1125	#DIV/0!	35.4	44.8	44.5	49.4	438545	649658
92	0	39897	52355	52006	57676	0	1200	1300	1325	1350	#DIV/0!	33.2	40.3	39.2	42.7	412519	615136
93	0	45060	54158	55624	59376	0	1100	1250	1275	1350	#DIV/0!	41.0	43.3	43.6	44.0	535456	668087
94	0	45692	54200	55332	60059	0	1175	1200	1200	1200	#DIV/0!	38.9	45.2	46.1	50.0	524459	687410
95	0	49729	54130	56384	59649	0	1075	1100	1125	1100	#DIV/0!	46.3	49.2	50.1	54.2	640833	726899
96	0	47869	52608	55061	58336	0	1075	1050	1050	1075	#DIV/0!	44.5	50.1	52.4	54.3	601374	714982
97.2	0	51618	53699	58340	62361	0	1050	1050	1075	1050	#DIV/0!	49.2	50.0	54.3	59.4	692686	728337
98	0	44138	54627	56578	60001	0	1050	1100	1100	1100	#DIV/0!	42.0	49.7	51.4	54.5	533605	738044
99	0	43745	49231	51271	55249	0	1000	1000	1050	1050	#DIV/0!	43.7	49.2	48.8	52.6	543093	661307
100	0	48698	49350	51611	53823	0	1900	1825	1625	1575	#DIV/0!	25.6	27.0	31.8	34.2	423332	444599
101	0	43227	51737	55924	59971	0	1575	1400	1400	1325	#DIV/0!	27.4	37.0	39.9	45.3	393306	574015
102	0	55926	62907	60920	59511	0	3200	3325	3025	1900	#DIV/0!	17.5	18.9	20.1	31.3	376635	446654
103	0	55929	70594	68822	61675	0	2950	3275	3250	2125	#DIV/0!	19.0	21.6	21.2	29.0	397662	546777
104	0	35708	38412	34318	34842	0	1525	2175	1675	1675	#DIV/0!	23.4	17.7	20.5	20.8	292257	260493
105	0	37829	38811	36682	34931	0	2125	2100	2100	2075	#DIV/0!	17.8	18.5	17.5	16.8	257911	271293
106	0	28215	39099	38070	35660	0	1775	1725	1675	1700	#DIV/0!	15.9	22.7	22.7	21.0	178375	313147
107	0	35813	38627	37503	36485	0	900	925	950	925	#DIV/0!	39.8	41.8	39.5	39.4	417410	464943
108	0	44507	40045	36641	37972	0	1725	1750	1725	1725	#DIV/0!	25.8	22.9	21.2	22.0	388610	322772
109	0	41744	34203	35758	33999	0	2625	1975	2025	1825	#DIV/0!	15.9	17.3	17.7	18.6	263980	228945
110	0	30488	36098	31850	36939	0	1900	1900	1900	1800	#DIV/0!	16.0	19.0	16.8	19.4	193959	257016
111	0	34836	36467	37301	36583	0	1700	1575	1800	1575	#DIV/0!	20.5	23.2	20.7	23.2	260860	296244
112	0	31154	35255	32632	35661	0	1875	1875	1850	1825	#DIV/0!	16.6	18.8	17.6	19.5	202854	249287
113	0	33347	33803	31563	28899	0	2750	2600	2700	2300	#DIV/0!	12.1	13.0	11.7	12.6	176007	186899
114	0		26776	21807	21187	0		1700	1500	1525	#DIV/0!		15.8	14.5	13.9		168244
115	0		28163	24389	20690	0		1625	1300	1325	#DIV/0!		17.3	18.8	15.6		188605
116	0		26729	26389	20379	0		1525	1550	1525	#DIV/0!		17.5	17.0	13.4		180351
117	0		43862	46678	43263	0		1425	1425	1500	#DIV/0!		30.8	32.8	28.8		430797
118	0		40075	40046	37855	0		900	925	950	#DIV/0!		44.5	43.3	39.8		503446
119	0		83856	95855	83758	0		2000	2300	2300	#DIV/0!		41.9	41.7	36.4		1012050
120	0		56333	65590	57006	0		1425	1475	1475	#DIV/0!		39.5	44.5	38.6		653725
121	0		63281	61633	65390	0		1750	1800	1775	#DIV/0!			36.2	34.2		691979

			Width/Depth Ratio					
	2010	2019	XXXX	1976	1989	1998	2010	2019
	429929	555904		51.9		78.3	53.0	45.4
	422921	483393		32.3		43.1	42.9	40.8
	440379	553836		57.4		55.5	60.6	54.1
	662540	754548		44.7	38.5	32.8	32.8	30.3
	484801	585141		36.7	37.5	32.0	35.0	31.2
	612558	634050		42.1	35.7	28.7	27.5	27.0
	582213	584068		41.6	34.2	35.5	35.4	36.4
	429553	431516		78.4	60.9	62.7	60.1	59.9
	338085	344044		72.3	82.6	83.7	81.3	82.2
	378964	361034		95.2	85.0	83.3	79.2	81.6
	423840	546408		97.8	151.3	116.2	53.5	48.3
	335178	345966		62.4	81.9	75.0	81.7	80.2
	326390	313951		70.3	96.4	95.7	99.8	104.1
	350697	413010			92.4	65.0	76.1	70.5
	499627	543922		14.8	21.5	22.0	26.0	27.6
	700339	885086		24.4	20.1	30.0	24.5	19.9
	400766	408001		70.1	62.7	65.4	62.6	61.9
	378981	412852		96.1	114.8	119.5	98.3	107.5
	958931	778922		34.8	32.6	34.8	27.8	33.4
	647607	760487		59.0	48.3	44.7	45.8	43.7
	455395	440354		40.3	54.8	73.1	69.5	73.9
	457467	455617		40.8	44.3	48.6	49.8	49.9
	543175	501553		32.8	30.3	30.0	30.6	33.2
	507480	466226		44.9	41.5	38.3	42.0	44.2
	680804	741504		29.8	32.8	34.3	36.2	34.4
	580703	721627		37.2	35.3	33.4	35.5	32.1
	625178	623823		24.6	23.6	22.0	26.3	27.2
	555648	524318		23.7	33.2	44.4	42.0	43.5
	636125	648909		26.6	23.3	25.3	25.1	24.8
	631737	640414		31.1	28.8	23.9	27.0	26.8
	704373	694674		23.5	32.3	33.3	29.8	30.9
	940894	955199		23.4	18.2	22.1	32.3	29.5
	730661	778459		24.5	20.5	31.8	28.2	23.0
	564467	608072		32.2	40.0	49.9	43.9	43.1
	625952	690478		30.1	33.2	37.7	33.9	32.0
	900441	953544		22.2	19.0	17.5	18.2	17.6
	949293	918061		27.6	24.0	25.0	23.4	24.6
	766884	841857		27.8	23.7	23.8	24.9	22.7
	663151	659274		23.4	20.8	22.1	21.9	22.8
	813457	862715		20.0	25.8	29.6	29.0	28.0
	833859	859924		22.2	26.2	28.0	27.7	28.0
	681223	713008		32.5	25.9	29.8	30.4	28.6
	811488	848752		25.9	25.0	25.1	25.7	25.8
	771150	761433			26.6	27.7	31.7	32.9
	964410	1001064		25.6	30.0	32.2	31.8	31.1
	699418	755888		54.2	41.2	45.5	43.8	39.8
	985530	922772		19.6	27.8	24.6	24.3	23.8
	766465	850669		28.6	29.1	31.7	33.7	30.8
	708322	740982		32.4	33.7	35.2	36.3	39.2
	617753	623209		32.8	43.1	57.9	56.6	56.3
	866619	931644		23.1	18.2	35.3	39.4	36.0
	1060247	1200660		21.9		40.2	31.7	30.1
	779729	911678		21.4	22.8	30.4	29.7	25.5
	731162	878265		32.2	38.3	39.3	45.8	41.9
	924494	837398		26.1	24.9	26.9	24.5	26.8
	689390	816689		25.5	36.5	48.4	47.4	41.8
	908666	897362		21.5	23.9	27.1	28.8	29.8
	806510	840310		15.7	17.8	18.4	22.6	22.0
	829652	822591		16.7	15.8	18.0	20.6	23.1
	799918	723147		18.0	16.6	18.3	18.9	20.8
	892252	762898		15.7	18.5	24.0	24.3	25.8
	868488	895886		15.8	15.8	17.1	18.6	18.3
	835376	801420		18.4	16.3	16.7	19.8	20.3
	992128	1080525		16.3	14.4	15.0	15.9	15.7
	1005150	1082062		19.9	15.3	17.8	19.8	18.9
	843384	854944		24.4	20.7	22.1	22.0	22.5
	922572	934573		19.0	17.2	17.1	18.7	20.6
	869686	787968		24.3	18.5	20.5	23.8	26.1
	884135	636782		23.7	32.1	35.1	26.8	44.1
	811667	1026976		26.9		28.4	32.6	31.4
	879108	1155413		22.0		22.5	22.2	20.1
	742347	651908		12.9		24.1	30.6	38.2
	892623	935096		21.6		18.5	21.2	22.8
	993193	903741		17.4		19.8	20.6	22.5
	938719	893566		24.5		21.6	19.9	20.5
	784449	819859		28.9		30.6	25.4	25.5
	824828	869647		34.3		33.3	31.4	33.0
	1042948	1145680		28.6		30.1	19.3	19.6
	875961	897317		29.0		26.3	26.1	25.7

881234	828983	20.5		21.3	19.2	20.7
992471	979274	20.3		28.4	17.9	19.4
869255	902767	46.6		24.6	23.1	24.1
711282	694383	29.8		35.0	34.3	37.7
800566	832904	36.4		29.4	26.7	26.9
810487	780684	22.5		22.1	23.3	25.4
758727	738751	32.4		28.1	25.9	28.9
848151	863316	27.9		22.6	19.6	20.9
740184	699546	26.6		25.8	23.7	26.3
778679	784723	26.4		24.7	23.0	23.7
733357	770958	24.6		28.2	28.2	29.1
772646	733660	26.8	25.3	25.6	23.9	25.6
749418	746082	32.5	25.7	26.4	22.8	24.5
704851	780695	36.1	32.3	33.8	31.6	31.5
739828	814872	26.9	28.9	29.2	30.7	29.8
815671	900798	30.2	26.6	26.0	24.0	22.6
854553	965991	23.2	22.4	22.4	20.3	18.8
836163	908545	24.1	21.0	20.0	19.8	18.8
836245	949274		21.4	21.5	19.8	17.7
862982	982344	25.0	22.2	21.4	20.2	18.7
775793	833142	22.9	20.3	21.5	20.0	19.9
566790	690249	74.1	67.5	51.2	46.1	46.3
761657	800591	57.4	37.9	35.0	29.3	31.0
591329	695700	183.1	175.7	150.2	60.7	52.7
582480	575563	155.6	151.9	153.5	73.2	92.6
263529	262857	65.1	123.2	81.8	80.5	78.7
229445	211775	119.4	113.6	120.2	123.3	131.8
271235	240619	111.7	76.1	73.7	81.0	87.1
422768	374313	22.6	22.2	24.1	23.5	25.2
298249	237997	66.9	76.5	81.2	78.4	87.7
238929	195508	165.1	114.0	114.7	98.0	105.7
267083	202368	118.4	100.0	113.3	97.7	105.9
297814	234246	83.0	68.0	86.9	67.8	76.3
258716	177127	112.8	99.7	104.9	93.4	114.7
156194	120634	226.8	200.0	231.0	183.0	221.2
122442	81429		107.9	103.2	109.8	136.5
129255	142796		93.8	69.3	84.9	75.2
114764	126534		87.0	91.0	114.1	113.3
406886	467736		46.3	43.5	52.0	46.6
441633	530049		20.2	21.4	23.8	23.2
920222	883061		47.7	55.2	63.2	61.4
651645	1182400		36.0	33.2	38.2	26.7
649891	723969			48.4	52.6	48.2

Summary of Geometric Data Parameters for Atchafalaya River cross sections at Bankfull Reference

RM	Cross sectional area (ft ²)					Width (ft)					Hydraulic Depth (ft)					Conveya				
	XXXX	1976	1989	1998	2010	2019	XXXX	1976	1989	1998	2010	2019	XXXX	1976	1989	1998	2010	2019		
0		101016		113493	115228	122681		1975		2050	2050	2050		51.1		55.4	56.2	59.8		1391883
1.1		108049		103405	104910	110583		1725		1900	1925	1925		62.6		54.4	54.5	57.4		1704146
2		112035		122432	121725	130739		2100		2125	2125	2125		53.4		57.6	57.3	61.5		1587730
3		132733	114736	115046	118580	124661		1800	1850	1850	1850	1850		73.7	62.0	62.2	64.1	67.4		2334070 1797699
4.1		104968	99551	104608	98167	104093		1650	1725	1700	1525	1525		63.6	57.7	61.5	64.4	68.3		1672767 1486680
5		99098	91092	102046	102265	106077		1675	1525	1525	1625	1625		59.2	59.7	66.9	62.9	65.3		1504624 1391929
6		108064	106663	106978	111304	113066		1925	1950	1975	2000	2000		56.1	54.7	54.2	55.7	56.5		1584332 1536969
7		111539	113270	112759	116714	117148		2200	2125	2125	2175	2175		50.7	53.3	53.1	53.7	53.9		1527913 1604298
8		110816	115351	118209	120949	121962		2150	2300	2500	2500	2500		51.5	50.2	47.3	48.4	48.8		1534775 1568749
9		115148	110839	112876	119700	119560		2300	2100	2100	2175	2175		50.1	52.8	53.8	55.0	55.0		1564128 1559577
10		110084	124869	142250	123778	133058		2225	2825	2825	2825	2825		49.5	44.2	50.4	43.8	47.1		1483606 1561043
11		105163	105985	112536	116148	117592		2000	2075	2075	2225	2225		52.6	51.1	54.2	52.2	52.9		1475998 1459026
12		102021	114207	119268	123566	123923		1850	2350	2325	2325	2325		55.1	48.6	51.3	53.1	53.3		1478098 1520924
13			108685	106058	110000	115116			2100	1975	2075	2075			51.8	53.7	53.0	55.5		1509385
14		121881	109905	104863	93466	98512		2125	2300	2300	2250	2250		57.4	47.8	45.6	41.5	43.8		1812674 1447249
15		137309	100214	100106	102745	110623		1850	1675	1775	1750	1750		74.2	59.8	56.4	58.7	63.2		2425035 1532989
16		107236	102440	101094	107527	109139		2150	2000	2000	2050	2050		49.9	51.2	50.5	52.5	53.2		1453038 1412851
17		117644	135137	137142	139742	148052		2725	2975	3025	3025	3025		43.2	45.4	45.3	46.2	48.9		1447784 1720409
18		162173	126965	120486	125224	117430		2000	1925	2000	2025	2025		81.1	66.0	60.2	61.8	58.0		3038146 2072630
19		104712	111070	119150	116950	124817		2050	1925	1900	1950	1950		51.1	57.7	62.7	60.0	64.0		1441531 1658466
20		109283	117133	113107	115112	115458		1775	2150	2225	2175	2175		61.6	54.5	50.8	52.9	53.1		1703931 1683348
21		95764	99300	98921	99806	100193		1625	1675	1725	1875	1875		58.9	59.3	57.3	53.2	53.4		1450235 1509751
22		82162	86911	88139	91765	91252		1400	1525	1550	1600	1600		58.7	57.0	56.9	57.4	57.0		1240800 1287088
23		81763	92187	96906	93719	92306		1625	1800	1800	1800	1800		50.3	51.2	53.8	52.1	51.3		1114356 1271362
24		89795	94154	96169	102876	106515		1450	1575	1625	1650	1650		61.9	59.8	59.2	62.3	64.6		1405535 1439508
25		105793	99428	95069	96632	104939		1825	1700	1875	1825	1825		58.0	58.5	50.7	52.9	57.5		1584587 1498124
26		101300	94450	95368	91048	91645		1500	1675	1675	1675	1675		67.5	56.4	56.9	54.4	54.7		1679907 1388874
27		94519	96512	93858	98925	97353		1450	1625	1750	1750	1750		65.2	59.4	53.6	56.5	55.6		1530933 1469158
28		77485	81535	80073	83105	84250		1325	1300	1325	1425	1425		58.5	62.7	60.4	58.3	59.1		1167408 1287098
29		85638	84765	89607	85825	86280		1425	1475	1475	1475	1475		60.1	57.5	60.8	58.2	58.5		1313903 1262319
30.1		88511	93315	91191	95556	95999		1300	1725	1725	1750	1750		68.1	54.1	52.9	54.6	54.9		1475826 1334720
31.1		107825	137044	137362	118098	116932		1675	1725	1825	1925	1925		64.4	79.4	75.3	61.3	60.7		1731907 2532639
32		94503	108292	95522	103390	102617		1550	2300	2350	2350	2350		61.0	47.1	40.6	44.0	43.7		1463921 1412020
33.2		74115	85450	85214	90539	93426		1350	1550	1675	1725	1725		54.9	55.1	50.9	52.5	54.2		1070594 1237737
34.1		85515	85103	82736	87576	90815		1425	1475	1600	1575	1575		60.0	57.7	51.7	55.6	57.7		1310772 1270711
35		102429	88458	89050	90026	92110		1575	1825	1800	1825	1825		65.0	48.5	49.5	49.3	50.5		1656467 1175951
36.1		75976	95954	93060	97831	97106		1625	1400	1400	1425	1425		46.8	68.5	66.5	68.7	68.1		986026 1607010
37.2		83760	81363	80694	83566	86460		1400	1300	1275	1300	1300		59.8	62.6	63.3	64.3	66.5		1281275 1282564
38		73686	76690	73870	74418	74619		1250	1200	1225	1350	1350		58.9	63.9	60.3	55.1	55.3		1116103 1225875
39.2		85151	88271	87774	92440	94820		1250	1425	1475	1625	1650		68.1	61.9	59.5	56.9	57.5		1420294 1381926
40		79049	91035	88285	92173	94208		1225	1525	1375	1525	1525		64.5	59.7	64.2	60.4	61.8		1271748 1390497
41		85463	82006	77952	83508	85328		1525	1325	1400	1375	1400		56.0	61.9	55.7	60.7	60.9		1251544 1283102
42		75735	83243	83678	84861	87064		1250	1300	1400	1350	1350		60.6	64.0	59.8	62.9	64.5		1168300 1323254
43.2			92761	86328	88118	89406			1700	1450	1575	1650			54.6	59.5	55.9	54.2		1334475
44		85439	98453	98678	102095	103590		1400	1600	1600	1650	1650		61.0	61.5	61.7	61.9	62.8		1324360 1534516
45		74097	97134	97042	95026	96869		1675	1725	1975	1975	1975		44.2	56.3	49.1	48.1	49.0		926806 1426998
45.9		96949	93443	92199	95786	92044		1350	1650	1625	1650	1650		71.8	56.6	56.7	58.1	55.8		1674999 1378029
47		82430	84425	82180	86262	89648		1400	1475	1525	1600	1600		58.9	57.2	53.9	53.9	56.0		1247539 1253891
48		83287	82988	80533	82972	87840		1550	1525	1525	1525	1625		53.7	54.4	52.8	54.4	54.1		1185976 1191727
49		77896	89876	86558	89635	89931		1550	1800	1975	1975	1975		50.3	49.9	43.8	45.4	45.5		1060801 1218692
50		116817	102790	95066	97668	99808		1975	1375	1675	1800	1800		59.1	74.8	56.8	54.3	55.4		1773356 1824110
51		87987		87461	103522	110256		1575		1800	1750	1750		55.9		48.6	59.2	63.0		1285813
52		86246	86122	76632	80442	85562		1325	1625	1675	1775	1775		65.1	53.0	45.8	45.3	48.2		1395586 1215136
53		76721	85985	88745	87737	95877		1450	1725	1800	1925	1925		52.9	49.8	49.3	45.6	49.8		1081303 1164611
54		78674	84805	79866	82819	79501		1325	1375	1400	1325	1325		59.4	61.7	57.0	62.5	60.0		1197416 1323834
55		111517	101656	84699	85479	91802		1725	1800	1950	1950	1950		64.6	56.5	43.4	43.8	47.1		1796289 1496380
56		65178	95113	83630	87080	87861		1100	1600	1825	1750	1825		59.3	59.4	45.8	49.8	48.1		990606 1448716
57		64080	70118	71498	74160	75775		1000	1075	1125	1200	1200		64.1	65.2	63.6	61.8	63.1		1026134 1136164
58.1		66998	73537	72845	73112	75133		1000	1025	1125	1125	1175		67.0	71.7	64.8	65.0	63.9		1105175 1269677
59		51779	63965	64847	69737	67650		900	975	1000	1075	1100		57.5	65.6	64.8	64.9	61.5		771657 1040494
60		74654	109365	88219	81567	75330		1100	1400	1400	1450	1450		67.9	78.1	63.0	56.3	52.0		1242114 1998537
61.1		70803	77158	72474	73788	75109		1050	1075	1075	1125	1125		67.4	71.8	67.4	65.6	66.8		1172989 1332596
62		71453	71876	70834	73186	71661		1100	1050	1100	1150	1150		65.0	68.5	64.4	63.6	62.3		1154606 1202766
63		68558	75965	76993	76542	80785		1050	1050	1075	1075	1075		65.3	72.3	71.6	71.2	75.1		1111

79	56657	68176	74474	73329	1300	1525	1425	1450	43.6	44.7	52.3	50.6	701664					
80	59340	76197	79256	80189	1375	1550	1600	1600	43.2	49.2	49.5	50.1	730098					
81	60870	71044	74367	77004	1600	1450	1425	1425	38.0	49.0	52.2	54.0	688534					
82	55317	69500	73127	74096	1200	1550	1625	1700	46.1	44.8	45.0	43.6	711173					
83	58348	69677	73113	75037	1325	1375	1375	1375	44.0	50.7	53.2	54.6	727620					
84	54358	65327	70455	70234	1100	1175	1225	1250	49.4	55.6	57.5	56.2	731988					
85	55980	64705	69827	70409	1350	1275	1350	1375	41.5	50.7	51.7	51.2	670655					
86	53663	63897	69521	71172	1150	1175	1225	1225	46.7	54.4	56.8	58.1	695536					
87	58212	64322	66926	66189	1225	1225	1350	1375	47.5	52.5	49.6	48.1	763706					
88	56391	64592	68521	69275	1200	1300	1275	1275	47.0	49.7	53.7	54.3	734343					
89	50465	62357	67134	69984	1100	1275	1425	1450	45.9	48.9	47.1	48.3	646722					
90	52215	61671	61363	67640	66294	1150	1175	1200	1325	1325	45.4	52.5	51.1	51.0	664542	864525		
91	50633	61113	61923	65294	66081	1275	1225	1225	1375	1375	39.7	49.9	50.5	47.5	48.1	589365	828195	
92	50066	62907	63058	69193	73898	1300	1325	1375	1575	1600	38.5	47.5	45.9	43.9	46.2	570969	824811	
93	54326	64490	66555	70937	75144	1175	1300	1325	1775	1800	46.2	49.6	50.2	40.0	41.7	699827	870680	
94	55613	64188	65139	70481	74317	1250	1250	1250	1575	1575	44.5	51.4	52.1	44.8	47.2	698255	886772	
95	59161	63495	65384	69518	74228	1275	1150	1125	1475	1475	46.4	55.2	58.1	47.1	50.3	763920	920655	
96	57598	61773	64082	67554	70580	1400	1200	1150	1275	1275	41.1	51.5	55.7	53.0	55.4	686416	854833	
97.2	58131	60431	65657	69775		1075	1125	1475	1475		54.1	53.7	44.5	47.3		831275		
98	50766	61600	64107	67288	72190	1125	1150	1150	1375	1375	45.1	53.6	55.7	48.9	52.5	643463	875319	
99	50275	55416	57735	62041	64985	1125	1025	1100	1375	1375	44.7	54.1	52.5	45.1	47.3	633116	792325	
100	60915	61485	62183	64469	73243	2200	2050	1950	1900	1900	27.7	30.0	31.9	33.9	38.5	557522	593527	
101	53375	60693	64839	68810	72061	1750	1575	1550	1575	1575	30.5	38.5	41.8	43.7	45.8	521040	692436	
102	72278	80849	77219	70111	75272	3275	3750	3350	3375	3375	22.1	21.6	23.1	20.8	22.3	568675	626283	
103	71587	87423	85520	73934	78339	3200	3400	3400	3475	3475	22.4	25.7	25.2	21.3	22.5	568358	761599	
104	43946	49595	43294	43544	43202	1750	2275	1875	1750	1750	25.1	21.8	23.1	24.9	24.7	376849	387032	
105	48745	49599	47363	45679	44314	2225	2150	2150	2150	2150	21.9	23.1	22.0	21.2	20.6	381643	401936	
106	37328	48156	46849	44444	42085	1825	1800	1750	1750	1750	20.5	26.8	26.8	25.4	24.0	279177	430758	
107	41007	43498	42253	41303	38770	1100	975	950	1025	1025	37.3	44.6	44.5	40.3	37.8	457614	547149	
108	53626	48977	46582	46878	41890	1900	1800	2050	1800	1800	28.2	27.2	22.7	26.0	23.3	497119	443063	
109	55060	44494	46568	44118	39756	2700	2125	2250	2150	2150	20.4	20.9	20.7	20.5	18.5	410977	338004	
110	36388	41929	37702	42639	36005	1950	1925	1925	1900	1800	18.7	21.8	19.6	22.4	20.0	255994	327011	
111	40193	41450	42799	41412	36245	1850	1650	1825	1600	1600	21.7	25.1	23.5	25.9	22.7	312940	355532	
112	36953	41035	38325	41324	33927	1925	1925	1925	1900	1900	19.2	21.3	19.9	21.7	17.9	264923	315484	
113	41705	41908	39796	36155	32303	2800	2775	2750	2425	2500	14.9	15.1	14.5	14.9	12.9	252469	256045	
114		32153	26307	25858	21132		1750	1500	1550	1525		18.4	17.5	16.7	13.9		223877	
115		33101	28570	24881	25802		1650	1375	1425	1425		20.1	20.8	17.5	18.1		244390	
116		32252	31276	25279	26899		2150	1600	1750	1775		15.0	19.5	14.4	15.2		196174	
117		45335	48202	44763	48197		1500	1500	1500	1475		30.2	32.1	29.8	32.7		439874	
118		40975	41106	38805	44132		900	950	950	1025		45.5	43.3	40.8	43.1		522431	
119		85856	98176	86072	82881		2000	2325	2325	2250		42.9	42.2	37.0	36.8		1052598	
120		57813	67241	58481	82978		1450	1525	1475	1475		39.9	44.1	39.6	56.3		674737	
121			65031	63433	67165			1750	1800	1775			37.2	35.2	37.8			

ID Number	Area (AD ^{2/3})		
	1998	2010	2019
1648585	1690800	1876973	
1485024	1508016	1646374	
1826353	1808821	2037520	
1805819	1899196	2064275	
1630455	1576756	1738562	
1681947	1617982	1719758	
1531494	1622430	1665449	
1592263	1660469	1670784	
1545700	1605872	1628346	
1607640	1731872	1728512	
1939738	1538358	1735357	
1612409	1622302	1656065	
1646601	1746691	1755114	
1509589	1552296	1674487	
1338288	1121065	1223760	
1472203	1552065	1755430	
1382041	1506696	1544533	
1743688	1799117	1980961	
1851568	1958214	1759338	
1880715	1791880	1997262	
1552130	1622655	1630809	
1471035	1412297	1421439	
1303332	1364739	1352047	
1381667	1306764	1274093	
1460449	1617591	1714070	
1302353	1362581	1563335	
1411433	1306499	1320806	
1334841	1457074	1418708	
1233092	1249784	1278621	
1384770	1288726	1300126	
1284488	1375324	1385976	
2448715	1837021	1806910	
1129261	1288494	1272482	
1169972	1269212	1337377	
1148363	1275810	1355422	
1200085	1210892	1257963	
1527050	1640269	1620072	
1281525	1340987	1419277	
1135936	1077883	1082739	
1337877	1367305	1412025	
1415596	1419587	1472205	
1136640	1290255	1321489	
1279197	1341615	1400142	
1316268	1288994	1280241	
1540341	1597169	1636345	
1301842	1257070	1297966	
1361355	1436099	1343812	
1172451	1231084	1312675	
1133547	1191361	1255796	
1075979	1140481	1146754	
1403991	1399818	1451301	
1164604	1571684	1745744	
980268	1022531	1133281	
1193242	1119489	1297890	
1183556	1304388	1218465	
1046580	1062703	1196917	
1070936	1178081	1162744	
1138654	1159205	1201601	
1174617	1181815	1201426	
1046695	1125898	1054023	
1396971	1197498	1048830	
1200511	1200061	1236104	
1137989	1166572	1126354	
1327828	1314908	1438608	
1404349	1378281	1455462	
1063570	1122988	1155144	
1142579	1222404	1270666	
1139179	1165082	1084586	
1054210	1114227	915167	
1123371	1152695	1398664	
1095364	1148152	1466884	
957919	1026872	953462	
1339498	1018381	1080230	
1060769	1224107	1143755	
1034647	1177594	1132304	
924686	1069275	1119187	
1024922	1166114	1247645	
828133	1235765	1356637	
1081099	1109456	1131397	

XXXX	Width/Depth Ratio				
	1976	1989	1998	2010	2019
	38.6		37.0	36.5	34.3
	27.5		34.9	35.3	33.5
	39.4		36.9	37.1	34.5
	24.4	29.8	29.7	28.9	27.5
	25.9	29.9	27.6	23.7	22.3
	28.3	25.5	22.8	25.8	24.9
	34.3	35.6	36.5	35.9	35.4
	43.4	39.9	40.0	40.5	40.4
	41.7	45.9	52.9	51.7	51.2
	45.9	39.8	39.1	39.5	39.6
	45.0	63.9	56.1	64.5	60.0
	38.0	40.6	38.3	42.6	42.1
	33.5	48.4	45.3	43.7	43.6
		40.6	36.8	39.1	37.4
	37.0	48.1	50.4	54.2	51.4
	24.9	28.0	31.5	29.8	27.7
	43.1	39.0	39.6	39.1	38.5
	63.1	65.5	66.7	65.5	61.8
	24.7	29.2	33.2	32.7	34.9
	40.1	33.4	30.3	32.5	30.5
	28.8	39.5	43.8	41.1	41.0
	27.6	28.3	30.1	35.2	35.1
	23.9	26.8	27.3	27.9	28.1
	32.3	35.1	33.4	34.6	35.1
	23.4	26.3	27.5	26.5	25.6
	31.5	29.1	37.0	34.5	31.7
	22.2	29.7	29.4	30.8	30.6
	22.2	27.4	32.6	31.0	31.5
	22.7	20.7	21.9	24.4	24.1
	23.7	25.7	24.3	25.3	25.2
	19.1	31.9	32.6	32.0	31.9
	26.0	21.7	24.2	31.4	31.7
	25.4	48.8	57.8	53.4	53.8
	24.6	28.1	32.9	32.9	31.9
	23.7	25.6	30.9	28.3	27.3
	24.2	37.7	36.4	37.0	36.2
	34.8	20.4	21.1	20.8	20.9
	23.4	20.8	20.1	20.2	19.5
	21.2	18.8	20.3	24.5	24.4
	18.3	23.0	24.8	28.6	28.7
	19.0	25.5	21.4	25.2	24.7
	27.2	21.4	25.1	22.6	23.0
	20.6	20.3	23.4	21.5	20.9
		31.2	24.4	28.2	30.5
	22.9	26.0	25.9	26.7	26.3
	37.9	30.6	40.2	41.0	40.3
	18.8	29.1	28.6	28.4	29.6
	23.8	25.8	28.3	29.7	28.6
	28.8	28.0	28.9	28.0	30.1
	30.8	36.0	45.1	43.5	43.4
	33.4	18.4	29.5	33.2	32.5
	28.2		37.0	29.6	27.8
	20.4	30.7	36.6	39.2	36.8
	27.4	34.6	36.5	42.2	38.6
	22.3	22.3	24.5	21.2	22.1
	26.7	31.9	44.9	44.5	41.4
	18.6	26.9	39.8	35.2	37.9
	15.6	16.5	17.7	19.4	19.0
	14.9	14.3	17.4	17.3	18.4
	15.6	14.9	15.4	16.6	17.9
	16.2	17.9	22.2	25.8	27.9
	15.6	15.0	15.9	17.2	16.9
	16.9	15.3	17.1	18.1	18.5
	16.1	14.5	15.0	15.1	14.3
	22.4	15.9	17.3	17.5	17.5
	23.0	25.4	24.7	24.6	24.2
	27.6	18.3	19.6	19.4	20.2
	28.4	21.5	24.4	25.5	28.1
	28.1	28.6	34.2	34.7	51.7
	24.1		25.3	27.8	28.9
	22.9		20.8	21.5	19.2
	12.4		25.5	29.1	35.5
	18.2		18.4	31.6	32.9
	16.0		21.9	23.4	24.3
	20.5		20.1	21.2	21.7
	24.6		31.8	23.9	23.2
	28.5		29.1	27.7	26.6
	25.4		47.5	24.6	23.9
	28.9		23.7	29.3	29.7

858767	1041036	1002790	29.8		34.1	27.3	28.7
1022520	1068997	1090048	31.9		31.5	32.3	31.9
951263	1038543	1100632	42.1		29.6	27.3	26.4
877176	925181	917677	26.0		34.6	36.1	39.0
954134	1033856	1079591	30.1		27.1	25.9	25.2
951608	1049782	1030314	22.3		21.1	21.3	22.2
886939	969351	970901	32.6		25.1	26.1	26.9
917157	1026688	1067631	24.6		21.6	21.6	21.1
901935	903161	875868	25.8		23.3	27.2	28.6
872979	975818	993767	25.5		26.2	23.7	23.5
833936	875711	927724	24.0		26.1	30.2	30.0
845400	930821	900151	25.3	22.4	23.5	26.0	26.5
846564	856218	873501	32.1	24.6	24.2	29.0	28.6
807910	861488	951278	33.8	27.9	30.0	35.9	34.6
906063	829195	904297	25.4	26.2	26.4	44.4	43.1
908795	888390	970426	28.1	24.3	24.0	35.2	33.4
981027	907047	1011784	27.5	20.8	19.4	31.3	29.3
934883	952972	1025174	34.0	23.3	20.6	24.1	23.0
860324	824653	912662		19.9	20.9	33.1	31.2
935506	900241	1012181	24.9	21.5	20.6	28.1	26.2
809348	786319	849470	25.2	19.0	21.0	30.5	29.1
625311	675697	835818	79.5	68.4	61.2	56.0	49.3
781334	853549	921818	57.4	40.9	37.1	36.1	34.4
625429	529819	596406	148.4	173.9	145.3	162.5	151.3
734165	567681	625163	143.0	132.2	135.2	163.3	154.1
351051	371127	366281	69.7	104.4	81.2	70.3	70.9
372198	350403	333123	101.6	93.2	97.6	101.2	104.3
419254	384000	350633	89.2	67.3	65.4	68.9	72.8
530409	485451	436859	29.5	21.9	21.4	25.4	27.1
373705	411876	341459	67.3	66.2	90.2	69.1	77.3
351036	330672	277996	132.4	101.5	108.7	104.8	116.3
273944	339247	265314	104.5	88.4	98.3	84.7	90.0
350660	362354	290181	85.2	65.7	77.8	61.8	70.6
281530	321978	231775	100.3	90.3	96.7	87.4	106.4
236328	219011	177869	188.0	183.8	190.0	162.7	193.5
177582	168821	121912		95.2	85.5	92.9	110.1
215930	167462	177918		82.2	66.2	81.6	78.7
226954	149933	164723		143.3	81.9	121.1	117.1
487208	430669	492605		49.6	46.7	50.3	45.1
506625	460259	542133		19.8	22.0	23.3	23.8
1190500	956059	917571		46.6	55.1	62.8	61.1
839228	679988	1218279		36.4	34.6	37.2	26.2
724167	681831	757017			47.1	51.1	46.9

Summary for Atchafalaya Volume at Low Water Reference (ac-ft)

	Volume (ac-ft)						
RM	XXXX	XXXX	1976	1989	1998	2010	2019
RM 0 to 1			5,310		4,715	4,894	5,598
RM 1 to 2			4,638		5,043	5,241	5,947
RM 2 to 3			6,149		4,714	4,847	5,523
RM 3 to 4			7,135	5,601	6,080	6,228	6,592
RM 4 to 5			4,788	5,364	5,612	6,756	6,976
RM 5 to 6			5,280	2,955	3,105	3,319	3,315
RM 6 to 7			5,121	5,861	5,692	6,179	6,383
RM 7 to 8			4,722	4,875	4,657	5,236	5,284
RM 8 to 9			4,712	5,149	5,330	5,630	5,595
RM 9 to 10			4,538	4,096	4,230	5,162	5,466
RM 10 to 11			4,666	4,474	5,077	5,506	5,661
RM 11 to 12			4,762	3,951	4,385	4,581	4,694
RM 12 to 13				4,340	4,769	5,030	5,143
RM 13 to 14				4,354	4,976	4,935	5,413
RM 14 to 15				8,197	10,655	10,948	11,901
RM 15 to 16			7,373	5,226	4,985	5,699	5,787
RM 16 to 17			4,431	5,142	5,304	6,125	6,006
RM 17 to 18			7,897	4,901	4,975	5,473	5,738
RM 18 to 19			8,762	5,565	5,860	6,256	7,037
RM 19 to 20			6,176	6,415	6,589	7,187	7,760
RM 20 to 21			6,190	5,898	5,105	5,891	5,690
RM 21 to 22			5,251	5,617	5,539	5,793	5,551
RM 22 to 23			4,722	5,605	6,043	5,943	5,881
RM 23 to 24			5,332	5,073	5,000	5,310	5,523
RM 24 to 25			6,473	5,932	6,144	6,527	6,970
RM 25 to 26			7,120	7,648	6,499	6,530	7,202
RM 26 to 27			7,087	7,314	7,240	7,069	7,360
RM 27 to 28			6,150	6,194	5,836	6,260	6,347
RM 28 to 29			5,806	5,917	6,244	5,923	6,001
RM 29 to 30			7,104	6,488	6,804	6,859	6,988
RM 30 to 31			7,624	6,618	6,584	6,816	6,965
RM 31 to 32			7,001	8,088	8,096	7,343	8,115
RM 32 to 33			7,538	7,842	8,878	8,827	9,184
RM 33 to 34			5,386	6,063	5,896	6,317	6,523
RM 34 to 35			6,782	5,911	5,878	6,181	6,472
RM 35 to 36			7,752	8,091	8,378	8,246	8,129
RM 36 to 37			6,802	7,343	6,798	7,459	7,527
RM 37 to 38			5,116	5,656	5,542	5,788	5,824
RM 38 to 39			7,989	7,836	7,352	7,746	7,843
RM 39 to 40			5,573	5,930	5,630	6,111	6,388
RM 40 to 41			6,700	6,591	6,276	6,857	6,980
RM 41 to 42			6,625	7,729	7,476	7,635	7,764
RM 42 to 43				7,402	7,367	7,945	8,348

RM 43 to 44		6,181	6,092	6,296	6,389
RM 44 to 45	6,381	6,699	6,899	7,155	7,468
RM 45 to 46		7,395	6,952	7,769	7,793
RM 46 to 47		7,238	7,033	7,560	7,613
RM 47 to 48	7,391	7,483	7,300	7,356	7,627
RM 48 to 49	7,035	7,379	7,077	7,338	7,108
RM 49 to 50	8,883	7,534	6,706	7,134	7,081
RM 50 to 51			11,802	10,918	10,726
RM 51 to 52			5,590	5,993	6,617
RM 52 to 53	7,798	7,285	7,025	7,364	7,777
RM 53 to 54	7,331	7,370	7,107	7,173	7,246
RM 54 to 55	9,308	8,017	7,527	7,808	8,253
RM 55 to 56	8,644	8,058	7,317	7,396	7,874
RM 56 to 57	6,234	7,698	7,069	7,650	8,409
RM 57 to 58	7,031	7,346	7,307	7,388	7,782
RM 58 to 59	5,132	6,600	6,455	6,649	6,704
RM 59 to 60	6,102	6,239	5,975	6,188	6,191
RM 60 to 61	7,838	8,824	7,802	7,720	7,489
RM 61 to 62	6,225	6,708	6,581	6,523	6,237
RM 62 to 63	6,808	7,214	7,087	7,269	7,266
RM 63 to 64	7,150	8,368	8,226	8,450	8,524
RM 64 to 65	5,213	6,955	7,220	7,569	7,833
RM 65 to 66	5,223	6,019	6,169	6,686	6,795
RM 66 to 67	5,846	6,534	6,374	6,793	6,824
RM 67 to 68	6,528	6,284	6,586	7,803	7,557
RM 68 to 69	6,337		7,600	8,736	9,734
RM 69 to 70	5,863		7,054	7,704	8,145
RM 70 to 71	7,951		6,399	7,219	7,560
RM 71 to 72	8,001		8,698	8,482	8,639
RM 72 to 73	6,122		7,244	7,206	7,526
RM 73 to 74	6,306		6,717	6,919	6,772
RM 74 to 75	5,888		5,600	6,174	6,096
RM 75 to 76	5,995		6,998	7,533	7,622
RM 76 to 77	6,148		7,158	7,879	8,138
RM 77 to 78	5,932		7,483	8,944	9,327
RM 78 to 79	5,551		6,363	6,940	6,885
RM 79 to 80	5,504		6,825	7,366	7,338
RM 80 to 81	5,665		6,859	7,437	7,378
RM 81 to 82	5,517		5,789	6,500	6,395
RM 82 to 83	5,499		6,681	7,155	7,195
RM 83 to 84	5,509		6,730	7,331	7,434
RM 84 to 85	5,388		5,332	5,783	5,866
RM 85 to 86	5,320		6,905	7,703	7,671
RM 86 to 87	5,507		5,857	6,307	6,369
RM 87 to 88	5,654		6,752	7,258	7,277
RM 88 to 89	5,368		6,584	7,105	7,155
RM 89 to 90	5,206		5,997	6,728	6,602

RM 90 to 91	5,080	6,068	5,988	6,495	6,526
RM 91 to 92	4,884	5,705	5,782	6,353	6,487
RM 92 to 93	5,149	6,147	6,285	6,841	7,428
RM 93 to 94	5,500	6,141	6,435	6,925	7,354
RM 94 to 95	5,783	6,227	6,445	6,984	7,466
RM 95 to 96	5,915	6,768	6,981	7,426	7,903
RM 96 to 97		7,210	7,642	8,300	8,852
RM 97 to 98		5,705	5,866	6,346	6,797
RM 98 to 99	5,326	6,121	6,142	6,701	7,222
RM 99 to 100	5,603	5,721	5,938	6,423	6,902
RM 100 to 101	5,571	5,519	5,930	6,361	6,771
RM 101 to 102	6,009	6,184	6,653	7,128	7,510
RM 102 to 103	6,779	8,112	7,751	8,229	8,427
RM 103 to 104	5,554	6,893	6,586	6,750	6,665
RM 104 to 105	4,902	4,248	3,931	3,949	3,883
RM 105 to 106	3,602	4,285	4,205	4,019	3,811
RM 106 to 107	4,657	4,862	4,918	4,975	4,707
RM 107 to 108	4,868	4,324	4,274	4,275	3,875
RM 108 to 109	4,705	4,325	4,020	4,227	3,777
RM 109 to 110	3,940	3,910	3,643	4,052	3,484
RM 110 to 111	4,355	4,360	3,970	4,518	3,781
RM 111 to 112	3,599	4,255	4,100	4,389	3,699
RM 112 to 113	3,909	3,682	3,498	3,835	3,183
RM 113 to 114		2,580	2,216	2,400	1,731
RM 114 to 115		3,610	3,301	3,096	2,938
RM 115 to 116		2,634	2,484	2,127	2,389
RM 116 to 117		3,318	3,261	2,847	2,890
RM 117 to 118		4,455	4,678	4,394	5,022
RM 118 to 119		5,214	5,794	5,421	5,902
RM 119 to 120		6,873	7,591	7,282	8,556
RM 120 to 121			6,701	6,304	7,170

Summary for Atchafalaya Volume at Bankfull Reference (ac-ft)

	Volume (ac-ft)						
RM	XXXX	XXXX	1976	1989	1998	2010	2019
RM 0 to 1			13,938		11,987	12,602	13,072
RM 1 to 2			12,005		11,896	12,323	13,057
RM 2 to 3			14,834		11,304	11,665	12,278
RM 3 to 4			15,847	12,046	12,507	12,881	13,118
RM 4 to 5			11,131	12,309	12,546	13,793	13,965
RM 5 to 6			12,555	6,998	7,106	7,398	7,403
RM 6 to 7			13,309	13,732	13,566	14,259	14,310
RM 7 to 8			13,476	13,883	13,737	14,411	14,503
RM 8 to 9			13,695	14,039	14,311	14,840	14,890
RM 9 to 10			13,650	12,792	13,099	13,232	13,184
RM 10 to 11			13,045	14,706	15,687	15,379	15,881
RM 11 to 12			12,557	11,126	11,729	12,319	12,382
RM 12 to 13				12,479	13,124	13,584	13,798
RM 13 to 14				9,581	10,220	10,554	10,853
RM 14 to 15				15,603	18,293	18,987	19,407
RM 15 to 16			14,821	11,879	11,714	12,683	12,612
RM 16 to 17			13,629	15,521	15,620	16,601	16,527
RM 17 to 18			16,959	11,151	11,178	11,958	12,142
RM 18 to 19			16,175	10,987	11,335	11,857	12,237
RM 19 to 20			12,969	11,895	12,142	13,085	13,493
RM 20 to 21			12,427	12,719	12,054	13,114	12,796
RM 21 to 22			10,783	11,041	11,032	11,727	11,344
RM 22 to 23			9,935	10,438	10,926	10,987	10,865
RM 23 to 24			10,397	9,659	9,596	10,098	10,272
RM 24 to 25			11,854	10,966	11,227	11,802	12,213
RM 25 to 26			12,551	12,591	11,361	11,486	12,126
RM 26 to 27			11,868	12,483	12,575	12,684	12,808
RM 27 to 28			10,425	10,447	10,157	10,806	10,796
RM 28 to 29			9,886	9,752	10,118	9,887	9,941
RM 29 to 30			11,610	11,195	11,528	11,609	11,685
RM 30 to 31			11,899	10,390	10,434	10,807	10,855
RM 31 to 32			11,036	12,020	12,382	11,510	12,222
RM 32 to 33			12,263	11,929	13,163	13,335	13,452
RM 33 to 34			8,707	9,756	9,784	10,400	10,568
RM 34 to 35			10,251	9,071	9,096	9,483	9,760
RM 35 to 36			11,894	11,779	12,082	12,098	11,892
RM 36 to 37			10,649	10,643	10,038	10,859	10,880
RM 37 to 38			7,634	8,297	8,187	8,431	8,502
RM 38 to 39			11,552	11,316	10,923	11,353	11,436
RM 39 to 40			7,961	8,549	8,246	8,884	9,103
RM 40 to 41			9,970	9,691	9,357	10,103	10,205
RM 41 to 42			9,770	10,833	10,653	11,004	11,078
RM 42 to 43				10,534	10,529	11,310	11,664

RM 43 to 44		8,514	8,447	8,764	8,864
RM 44 to 45	9,669	9,333	9,680	10,003	10,281
RM 45 to 46		10,252	9,805	10,747	10,790
RM 46 to 47		10,048	9,845	10,424	10,444
RM 47 to 48	10,043	10,089	9,972	10,180	10,440
RM 48 to 49	9,769	10,262	10,114	10,483	10,272
RM 49 to 50	11,801	10,183	9,524	10,056	9,996
RM 50 to 51			14,874	14,318	13,696
RM 51 to 52			7,210	7,627	8,237
RM 52 to 53	9,877	9,114	8,940	9,324	9,730
RM 53 to 54	9,418	9,518	9,351	9,532	9,593
RM 54 to 55	11,527	10,233	9,904	10,203	10,611
RM 55 to 56	10,709	10,153	9,523	9,598	10,099
RM 56 to 57	7,834	9,681	9,136	9,845	10,573
RM 57 to 58	8,739	9,117	9,147	9,567	9,939
RM 58 to 59	6,479	8,164	8,073	8,448	8,496
RM 59 to 60	7,663	7,776	7,537	7,844	7,888
RM 60 to 61	9,697	10,713	9,707	9,763	9,534
RM 61 to 62	7,759	8,297	8,195	8,240	7,981
RM 62 to 63	8,485	8,888	8,787	9,076	9,073
RM 63 to 64	9,096	10,201	10,095	10,403	10,488
RM 64 to 65	6,906	8,840	9,160	9,657	9,940
RM 65 to 66	6,875	7,689	7,858	8,497	8,591
RM 66 to 67	7,642	8,163	8,032	8,665	8,678
RM 67 to 68	8,412	7,636	8,086	9,509	9,345
RM 68 to 69	8,003		9,188	10,656	11,676
RM 69 to 70	7,419		8,731	9,522	10,007
RM 70 to 71	9,423		7,891	8,867	9,269
RM 71 to 72	9,423		10,560	10,484	10,648
RM 72 to 73	7,484		8,679	8,767	9,080
RM 73 to 74	7,733		8,148	8,414	8,239
RM 74 to 75	7,440		6,912	7,481	7,442
RM 75 to 76	7,714		8,912	9,476	9,588
RM 76 to 77	7,903		8,941	9,740	10,010
RM 77 to 78	7,563		9,278	10,860	11,250
RM 78 to 79	7,110		8,026	8,704	8,645
RM 79 to 80	7,030		8,504	9,171	9,129
RM 80 to 81	7,285		8,114	8,744	8,677
RM 81 to 82	7,042		7,174	7,978	7,891
RM 82 to 83	6,889		8,057	8,581	8,651
RM 83 to 84	6,831		8,187	8,843	8,963
RM 84 to 85	6,687		6,344	6,815	6,922
RM 85 to 86	6,645		8,284	9,199	9,166
RM 86 to 87	6,780		7,030	7,521	7,625
RM 87 to 88	6,946		8,087	8,640	8,687
RM 88 to 89	6,476		7,619	8,175	8,241
RM 89 to 90	6,223		7,125	7,917	7,797

RM 90 to 91	6,233	7,148	7,080	7,643	7,677
RM 91 to 92	6,103	6,784	6,888	7,487	7,648
RM 92 to 93	6,327	7,392	7,592	8,211	8,850
RM 93 to 94	6,663	7,250	7,577	8,104	8,552
RM 94 to 95	6,956	7,342	7,570	8,116	8,616
RM 95 to 96	7,076	7,906	8,117	8,579	9,058
RM 96 to 97		8,117	8,550	9,226	9,779
RM 97 to 98		6,437	6,602	7,086	7,540
RM 98 to 99	6,124	6,944	6,971	7,562	8,082
RM 99 to 100	6,739	6,828	7,030	7,542	8,023
RM 100 to 101	6,927	6,576	6,935	7,340	7,791
RM 101 to 102	7,615	7,020	7,479	7,950	8,337
RM 102 to 103	8,719	9,871	9,482	9,966	10,199
RM 103 to 104	7,002	8,413	8,111	8,263	8,206
RM 104 to 105	6,179	5,369	5,053	5,064	5,007
RM 105 to 106	4,695	5,428	5,355	5,187	4,979
RM 106 to 107	5,697	5,708	5,776	5,847	5,581
RM 107 to 108	5,735	5,135	5,081	5,089	4,686
RM 108 to 109	5,928	5,538	5,233	5,454	5,006
RM 109 to 110	4,988	4,544	4,273	4,609	4,044
RM 110 to 111	5,105	4,992	4,597	5,157	4,420
RM 111 to 112	4,208	4,904	4,742	5,040	4,350
RM 112 to 113	4,767	4,308	4,124	4,441	3,819
RM 113 to 114		3,134	2,765	2,948	2,276
RM 114 to 115		4,151	3,850	3,662	3,491
RM 115 to 116		3,138	2,964	2,612	2,896
RM 116 to 117		3,492	3,437	3,029	3,073
RM 117 to 118		4,596	4,824	4,547	5,173
RM 118 to 119		5,329	5,911	5,544	6,025
RM 119 to 120		7,033	7,751	7,442	8,717
RM 120 to 121			6,892	6,500	7,365

Appendix C: Old River Geometric Data Tables

Summary for cross sections at LWRP Reference

RM			Cross sectional area (ft2)							
			1963	1975	1983	1992	2004	2013		
	1.0 XS1 (US)	Hydropower plant inflow channel (upper)				5,017	10,069	10,186		
	2.0 XS2 (US)	Hydropower plant inflow channel (lower)					7,842	7,669		
	3.0 XS3 (DS)	Hydropower plant outflow channel (upper)				14,493	15,308	15,650		
	4.0 XS4 (DS)	Hydropower plant outflow channel (middle)				20,891	30,431	30,145		
	5.0 XS5 (DS)	Hydropower plant outflow channel (lower)				14,641	30,164	31,093		
	6.0 XS6 (US)	Auxiliary structure inflow channel (upper)				543	4,876	3,869		
	7.0 XS7 (US)	Auxiliary structure inflow channel (lower)				2,228	5,449	5,459		
	8.0 XS8 (DS)	Auxiliary structure outflow channel (upper)				7,739	9,790	9,781		
	9.0 XS9 (DS)	Auxiliary structure outflow channel (lower)				9,607	9,705	9,701		
	10.0 XS10 (US)	Low sill structure inflow channel	14,667	11,944		3,138	4,532	71	1175	825
	11.0 XS11	Low sill structure outflow channel	20,332	4,130	76,790	73,123	56,740	76,404	950	825
	12.0 XS12	Outflow channel (below aux. channel)	18,306	13,102	30,764	23,595	12,422	29,475	1075	925
	13.0 XS13	Outflow channel (above hydro plant channel)	17,109	17,993	26,556	20,013	13,987	21,595	1150	1550
	14.0 XS14	Outflow channel (below hydro plant channel)	16,203	16,164	35,954	38,966	40,932	43,727	1050	1175
	15.0 XS15	Outflow channel (upper middle)	15,243	21,199	30,989	26,887	42,873	41,463	650	1050
	16.0 XS16	Outflow channel lower middle)	16,039	23,300	27,279	27,028	39,842	37,279	675	1075
	17.0 XS17	Outflow channel (at Red River)	21,532	25,476	38,720	29,754	41,252	45,402	1225	1050

Width (ft)				Hydraulic Depth (ft)						Conveyance (AD ^{2/3})			
1983	1992	2004	2013	1963	1975	1983	1992	2004	2013	1963	1975	1983	1992
	475	550	550				10.6	18.3	18.5				24,150
		425	425					18.5	18.0				
	625	625	625				23.2	24.5	25.0				117,847
	600	700	700				34.8	43.5	43.1				222,753
	625	650	650				23.4	46.4	47.8				119,861
	175	500	400				3.1	9.8	9.7				1,156
	600	675	675				3.7	8.1	8.1				5,343
	725	725	725				10.7	13.5	13.5				37,520
	700	700	700				13.7	13.9	13.9				55,068
	575	575	100	12.5	14.5		5.5	7.9	0.7	78,926	70,953		9,727
1550	1350	1300	1325	21.4	5.0	49.5	54.2	43.6	57.7	156,729	12,085	1,035,827	1,046,818
1475	1525	1525	1525	17.0	14.2	20.9	15.5	8.1	19.3	121,166	76,697	233,101	146,500
1650	1475	1450	1525	14.9	11.6	16.1	13.6	9.6	14.2	103,492	92,248	169,281	113,849
1350	1275	1300	1325	15.4	13.8	26.6	30.6	31.5	33.0	100,428	92,799	320,639	380,895
1425	1475	1600	1625	23.5	20.2	21.7	18.2	26.8	25.5	124,878	157,181	241,437	186,226
1450	1750	1850	1850	23.8	21.7	18.8	15.4	21.5	20.2	132,571	181,132	192,964	167,618
1350	1125	1250	1200	17.6	24.3	28.7	26.4	33.0	37.8	145,565	213,520	362,801	264,129

2004	2013
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69,944 71,297
54,754 52,755
129,106 133,941
376,240 370,362
389,535 409,732
22,257 17,565
21,926 21,995
55,513 55,428
56,009 55,970
17,947 56
703,376 1,140,377
50,291 212,276
63,381 126,402
408,145 449,897
383,907 359,363
308,404 276,058
424,433 511,690

Width/Depth Ratio					
1963	1975	1983	1992	2004	2013

45.0 30.0 29.7
23.0 23.6
27.0 25.5 25.0
17.2 16.1 16.3
26.7 14.0 13.6
56.4 51.3 41.4
161.6 83.6 83.5
67.9 53.7 53.7
51.0 50.5 50.5
94.1 57.0 105.4 73.0 141.0
44.4 164.8 31.3 24.9 29.8 23.0
63.1 65.3 70.7 98.6 187.2 78.9
77.3 133.5 102.5 108.7 150.3 107.7
68.0 85.4 50.7 41.7 41.3 40.1
27.7 52.0 65.5 80.9 59.7 63.7
28.4 49.6 77.1 113.3 85.9 91.8
69.7 43.3 47.1 42.5 37.9 31.7

Summary for cross sections at Bankfull Reference

RM			Cross sectional area (ft2)							
			1963	1975	1983	1992	2004	2013		
	1.0 XS1 (US)	Hydropower plant inflow channel (upper)				25,270	30,715	30,836		
	2.0 XS2 (US)	Hydropower plant inflow channel (lower)				15,991	23,639	23,437		
	3.0 XS3 (DS)	Hydropower plant outflow channel (upper)				35,414	36,004	36,428		
	4.0 XS4 (DS)	Hydropower plant outflow channel (middle)				43,082	53,843	53,560		
	5.0 XS5 (DS)	Hydropower plant outflow channel (lower)				37,719	53,794	54,725		
	6.0 XS6 (US)	Auxiliary structure inflow channel (upper)				18,498	23,680	22,023		
	7.0 XS7 (US)	Auxiliary structure inflow channel (lower)				24,977	28,654	27,512		
	8.0 XS8 (DS)	Auxiliary structure outflow channel (upper)				34,073	33,598	33,589		
	9.0 XS9 (DS)	Auxiliary structure outflow channel (lower)				35,038	35,540	35,536		
	10.0 XS10 (US)	Low sill structure inflow channel	52,787	41,149		30,578	29,431	24,774	1375	1175
	11.0 XS11	Low sill structure outflow channel	52,698	36,733	123,581	119,471	99,334	119,013	1250	1450
	12.0 XS12	Outflow channel (below aux. channel)	53,084	47,340	77,248	72,065	60,879	77,966	1375	1625
	13.0 XS13	Outflow channel (above hydro plant channel)	54,890	66,487	79,943	72,365	65,126	72,725	1900	2100
	14.0 XS14	Outflow channel (below hydro plant channel)	51,830	55,240	78,624	80,986	83,096	86,043	1875	1875
	15.0 XS15	Outflow channel (upper middle)	41,818	58,346	76,013	75,239	92,543	91,308	2100	1650
	16.0 XS16	Outflow channel lower middle)	38,005	58,950	73,399	80,055	93,389	91,519	1400	1775
	17.0 XS17	Outflow channel (at Red River)	62,119	62,097	81,528	68,285	79,926	83,260	1700	1700

Width (ft)				Hydraulic Depth (ft)						Conveyance ($AD^{2/3}$)			
1983	1992	2004	2013	1963	1975	1983	1992	2004	2013	1963	1975	1983	1992
	950	875	875				26.6	35.1	35.2				225,180
	700	650	650				22.8	36.4	36.1				128,744
	775	775	775				45.7	46.5	47.0				452,647
	975	950	950				44.2	56.7	56.4				538,465
	975	975	975				38.7	55.2	56.1				431,444
	900	875	875				20.6	27.1	25.2				138,792
	1025	925	850				24.4	31.0	32.4				209,940
	1075	950	950				31.7	35.4	35.4				341,255
	1075	1050	1050				32.6	33.8	33.8				357,521
	1300	1125	1200	38.4	35.0		23.5	26.2	20.6	600,728	440,455		251,022
1750	1850	1675	1675	42.2	25.3	70.6	64.6	59.3	71.1	638,342	316,842	2,111,358	1,923,046
1800	1925	1900	1900	38.6	29.1	42.9	37.4	32.0	41.0	606,371	448,209	946,884	806,470
2075	2300	2300	2300	28.9	31.7	38.5	31.5	28.3	31.6	516,790	665,393	911,908	721,209
1625	1850	1850	1850	27.6	29.5	48.4	43.8	44.9	46.5	473,836	526,940	1,043,984	1,005,928
1725	2075	2100	2100	19.9	35.4	44.1	36.3	44.1	43.5	307,223	628,574	948,324	824,249
1800	2025	2100	2150	27.1	33.2	40.8	39.5	44.5	42.6	343,275	609,072	869,556	929,033
1700	1700	1700	1700	36.5	36.5	48.0	40.2	47.0	49.0	684,026	683,633	1,076,167	800,905

2004	2013
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329,290 331,455
 259,490 255,792
 465,279 474,451
 794,454 787,497
 779,638 802,235
 213,444 189,145
 282,629 279,416
 362,001 361,841
 371,883 371,812
 259,364 186,446
 1,510,601 2,041,638
 614,148 927,557
 605,021 727,201
 1,049,987 1,112,790
 1,154,592 1,129,023
 1,172,238 1,115,727
 1,041,159 1,114,544

Width/Depth Ratio					
1963	1975	1983	1992	2004	2013

35.7 24.9 24.8
 30.6 17.9 18.0
 17.0 16.7 16.5
 22.1 16.8 16.9
 25.2 17.7 17.4
 43.8 32.3 34.8
 42.1 29.9 26.3
 33.9 26.9 26.9
 33.0 31.0 31.0
 35.8 33.6 55.3 43.0 58.1
 29.6 57.2 24.8 28.6 28.2 23.6
 35.6 55.8 41.9 51.4 59.3 46.3
 65.8 66.3 53.9 73.1 81.2 72.7
 67.8 63.6 33.6 42.3 41.2 39.8
 105.5 46.7 39.1 57.2 47.7 48.3
 51.6 53.4 44.1 51.2 47.2 50.5
 46.5 46.5 35.4 42.3 36.2 34.7

Volume by polygon at Bankfull Reference

Reach	Poly ID	1963		1975		198
		Vol. (ft ³)	Vol. (ac-ft)	Vol. (ft ³)	Vol. (ac-ft)	Vol. (ft ³)
Hydropower Plant Inflow Channel	1					
Hydropower Plant Outflow Channel	2					
Low Sill Inlet	3	38,424,654	882	35,364,520	812	
Outflow Low Sill to Auxiliary Channel	4	112,236,948	2,577	152,774,650	3,507	194,585,864
Auxiliary Inflow Channel	5					
Auxiliary Outflow Channel	6					
Outflow Auxiliary to Power Plant	7	419,779,374	9,637	474,996,443	10,904	597,281,885
Outflow Power Plant to Red River	8	1,057,870,689	24,285	1,392,866,639	31,976	1,744,559,853
Outflow Low Sill to Red River	9	1,791,121,554	41,118	2,254,934,367	51,766	2,799,279,732

3	1992		2004		2013	
Vol. (ac-ft)	Vol. (ft ³)	Vol. (ac-ft)	Vol. (ft ³)	Vol. (ac-ft)	Vol. (ft ³)	Vol. (ac-ft)
	45,420,040	1,043	54,015,708	1,240	53,443,529	1,227
	264,287,311	6,067	328,564,517	7,543	328,970,763	7,552
	26,047,052	598	21,252,006	488	17,034,792	391
4,467	190,966,410	4,384	153,721,113	3,529	197,599,091	4,536
	129,436,653	2,971	128,688,401	2,954	128,872,253	2,958
	75,679,299	1,737	75,469,044	1,733	75,781,129	1,740
13,712	546,100,718	12,537	477,172,657	10,954	567,026,792	13,017
40,050	1,731,248,530	39,744	1,949,640,094	44,758	1,963,446,610	45,075
64,263	2,738,524,273	62,868	2,844,276,538	65,296	3,009,091,138	69,079

Abbreviations

GIS	Geographic Information System
IQR	Interquartile range
LWRP	Low Water Reference Plane
MR&T	Mississippi River & Tributaries
MRC	Mississippi River Commission
OMAR	Old River, Mississippi River, Atchafalaya River, and Red River
ORCC	Old River Control Complex
ORCS	Old River Control Structure
RM	River Mile
TIN	Triangulated irregular network
USACE	US Army Corps of Engineers
W/D	Width/Depth
WBPC	Whiskey Bay Pilot Channel

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13. SUPPLEMENTARY NOTES Funding provided by the New Orleans District through Project Number 478534.					
14. ABSTRACT The Old River Control Complex (ORCC) consists of the Low Sill, Auxiliary, and Overbank structures as features of the Old River Control Structure (ORCS) and the privately owned hydro-electric power plant. Operations of the ORCC manage the hydrologic connectivity between the Mississippi River and the Atchafalaya River/Red River systems. The morphology of the Old, the Mississippi, the Atchafalaya, and the Red Rivers (OMAR) has been influenced by the flow distribution at the ORCC, as well as the accompanying bed sediments. A geomorphic assessment of the OMAR is underway to understand the morphological changes associated with operation of the ORCC. Supporting the geomorphic assessment, a channel geometry analysis herein documents observed adjustments of the affected river channels. Historical hydrographic survey data were used in the Geographic Information System to create river channel geometric models, which inform the analysis. Geometric parameters for cross sections and volume polygons were computed for each survey and evaluated for morphological trends which may be ascribed to the influence of the ORCC. Additionally, the geometric parameters for the Atchafalaya River were used to extend the geometry analyses from the 1951 Mississippi River Commission report on the Atchafalaya River, which was the primary catalyst for the initial development of the ORCS.					
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