MIDDLE NEW RIVER WATERCOURSE MASTER PLAN

PROJECT ALTERNATIVES ANALYSIS

Prepared for:

Flood Control District
of
Maricopa County

Prepared by:

Stantec Consulting, Inc.
8211 South 48th Street
Phoenix, Arizona 85044
(602) 438-2200

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Stantec Consulting, Inc.
Project No. 82000058

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EXECUTIVE SUMMARY

The Flood Control District of Maricopa County, the City of Peoria, and the City of Glendale, have prepared the Middle New River Watercourse Master Plan. Pursuant to Arizona Revised Statutes §48-3609.01, the Flood Control District is authorized to prepare and enact watercourse master plans for river reaches within Maricopa County. The study reach is located along New River and extends approximately 8.5 miles from Skunk Creek north to the New River Dam. This portion of New River, known as the middle New River, is currently under development pressure. The Middle New River Watercourse Master Plan provides both the Cities of Glendale and Peoria with a comprehensive approach to river management. The Watercourse Master Plan also honors commitments to the U.S. Army Corps of Engineers to maintain a floodwater conveyance corridor downstream of New River Dam.

The Middle New River Watercourse Master Plan was developed over a period of approximately 18 months. A Steering Committee, consisting of staff from the Flood Control District, the City of Glendale, and the City of Peoria, met monthly to review and direct the Watercourse Master Plan efforts. The public also played an important role in the development of the Watercourse Master Plan. Nine public meetings were held to inform and obtain public input on the alternatives under consideration. Newsletters were issued to distribute project information. A telephone Hot Line and e-mail address were established to receive public opinions and response.

Seven alternatives, including the No Action alternative, were considered for the management of the New River channel and floodplain under the Middle New River Watercourse Master Plan. The Preferred Alternative selected combines two alternatives which are the most cost effective, protect infrastructure and adjoining property, and have the least overall environmental impact while

meeting the requirements of the Corps of Engineers to maintain an adequate floodwater conveyance corridor.

The Middle New River Watercourse Master Plan Preferred Alternative consists of the following:

- From above the New River confluence with Skunk Creek to Pinnacle Peak Road (approximately 5.5 miles) – Proposed new channel bank improvements will consist of rock filled wire baskets for bank armoring. The channel bottom will be graded as required and will remain natural. Three new grade control structures are proposed at 83rd Avenue, Deer Valley Road and Pinnacle Peak Road to maintain the expected long term slope of the channel bottom. The plan utilizes most of the existing bank armoring.

- From Pinnacle Peak Road to below the New River Dam (approximately 3.0 miles) – This portion of the New River channel and floodplain will be managed using predominantly non-structural controls and procedures. The existing natural channel, with minor improvements to maintain channel location and protect sensitive bank areas, will be utilized to convey floodwaters. An erosion setback buffer zone has been delineated along the 100-year floodplain of the New River and the channel will be permitted to migrate from side to side within this delineated zone. New construction will not be permitted within the buffer zone.

1. INTRODUCTION

The New River, from its confluence with Skunk Creek northward to the New River Dam, is subject to development pressure in response to increasing populations in the adjoining Cities of Glendale and Peoria. Several residential development projects that include construction within the floodplain and channelization of the riverbed have been proposed for completion within the next few years. To provide the Cities of Glendale and Peoria with a comprehensive program for the management of the New River and the adjoining land subject to development pressure and to fulfill its obligation to the U.S. Army Corps of Engineers to maintain the New River as a floodwater conveyance corridor downstream of the New River Dam, the Flood Control District of Maricopa County, under the authority of Arizona Revised Statutes §48-3609.01, contracted with Stantec Consulting, Inc. for the development and preparation of the Middle New River Watercourse Master Plan.

Project Goals

To direct the development of the Middle New River Watercourse Master Plan a Steering Committee comprised of personnel from the Flood Control District of Maricopa County, the City of Glendale, and the City of Peoria. The Steering Committee, through public meetings which were open to interested parties, established three goals to be accomplished by the Middle New River Watercourse Master Plan. The three goals to be accomplished were:

- To assure the requirements of the U.S. Army Corps of Engineers for the future condition 100-year conveyance capacity of the New River channel below the New River Dam.

- To establish a Watercourse Master Plan for planned developments bordering or within the New River floodplain for both Glendale and Peoria.

- To include in the Master Plan Study the size, alignment, grades, and construction requirements of proposed channel/floodplain improvements in sufficient detail to permit incorporation of the Master Plan into development plans for adjoining areas and individual parcels.

To be certain that the Master Plan developed by Stantec for the Middle New River Watercourse was the most economically efficient and environmentally beneficial plan that accomplished the project goals, Stantec was charged by the Steering Committee to obtain a number of project objectives. Among the project objectives to be obtained, Stantec was:

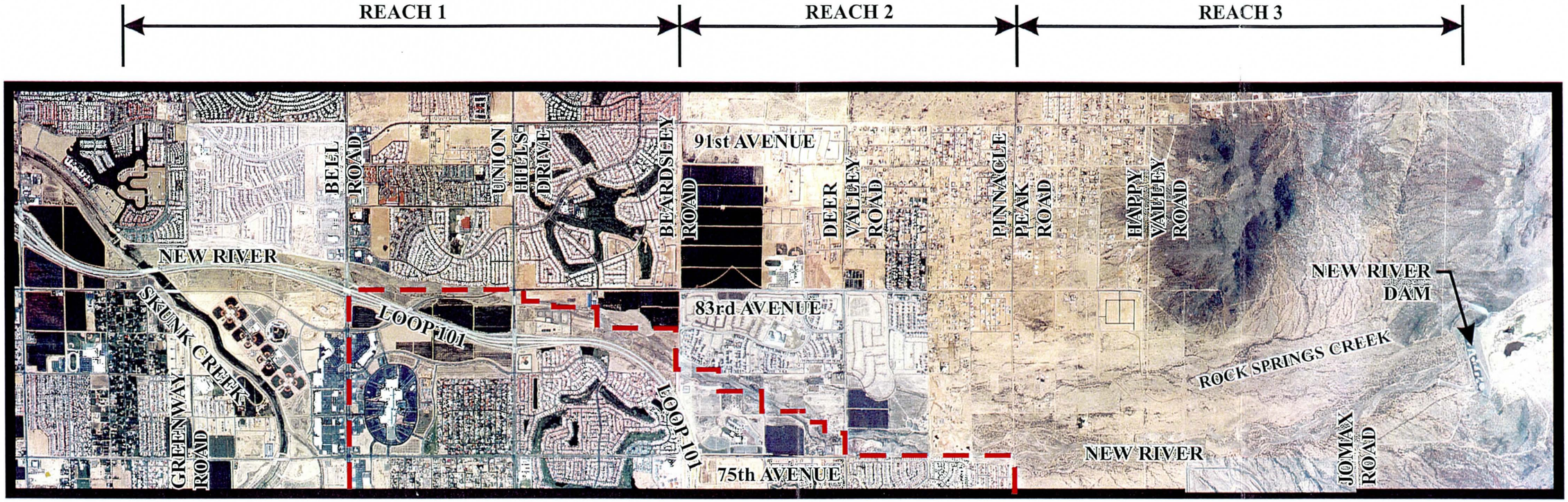
- To formulate channel alternatives to be studied.
- To conduct feasibility level studies of the alternatives, to evaluate areas required for floodwater conveyance, project costs and impacts to the existing environment.
- To select a specific preferred plan that would be developed by Stantec into the Master Plan.

Purpose of this Report

It is the purpose of this report to present the channel alternatives which were formulated by Stantec, including the preferred plan, along with summaries of the results of the feasibility level studies completed for each alternative. Within the context of this report, rationale for the elimination of alternatives and the selection of a preferred plan will be presented.

Location

The project extends from the confluence of New River and Skunk Creek northward, upstream along New River to the downstream face of the New River Dam, a distance of approximately 8.5 miles. Figure 1-1 displays the location of the Middle New River Master Plan project area.



Legend

CITY OF PEORIA/GLENDALE BOUNDARY

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Client/Project
FLOOD CONTROL DISTRICT OF MARICOPA COUTNY
MIDDLE NEW RIVER WATERCOURSE
JURRSDICTIONAL DELINEATION

Figure No.
1-1

Title
Vicinity Map

Date: December 21, 1999
Project Number:28900058

The New River and the adjoining land with which this project is concerned lies within the jurisdictional limits of the Cities of Glendale and Peoria. It also includes currently unincorporated portions of Maricopa County. Land within the project area is both publicly and privately owned.

The nature and intensity of the development within and adjacent to the New River channel and floodplain varies significantly within 8.5 mile distance of the study area. From the Skunk Creek confluence northward to the crossing of the Beardsley Road Alignment, designated Reach 1, the development within and adjoining the New River channel and floodplain is characterized as intense existing residential and commercial development. From the crossing of the Beardsley Road Alignment northward to the crossing of the Pinnacle Peak Road Alignment, designated Reach 2, the land area within and adjoining the New River channel and floodplain is being developed intensely for residential and commercial use. With the exception of the Terramar residential development on the east bank between Happy Valley Road and Jomax Road, the land area within and adjoining the channel and floodplain of the New River between the crossing of the Pinnacle Peak Road Alignment and the New River Dam, designated as Reach 3, is characterized as predominantly undeveloped. The designated reaches and their characteristic development are clearly visible in Figure 1-1.

Hydrologic/Hydraulic Setting

During the 1970's and the 1980's, the U.S. Army Corps of Engineers conducted hydrologic, hydraulic, and design studies to develop a comprehensive plan to mitigate experienced and potential flooding in the metropolitan Phoenix area. The following paragraphs contain information extracted from the Corps' studies of historic flooding of the Phoenix area.

Storm types experienced over the New River watershed include general winter storms, which normally originate in the northern Pacific Ocean, general summer storms, which normally originate in the southern Pacific Ocean and the Gulf of

California (Sea of Cortez), and summer thunderstorms which are generated by the clockwise atmospheric circulation of moist air originating in the Gulf of Mexico about a stationary high located over the Four Corners area of Utah, Colorado, Arizona, and New Mexico. The floods that can result from the summer thunderstorms often provide little or no warning to the communities that they affect.

Stormwater runoff is generated from two distinct sub-areas of approximately equal size, a mountainous sub-area and a flat valley sub-area. As implied, the runoff is not perennial and is experienced only during and immediately following relatively heavy precipitation events. Flooding is experienced when stormwater runoff overtops the generally dry streambeds and spreads as overbank flow. Mountainous areas are characterized by well-defined and incised streambeds. Flat valley areas, however, have poorly defined braided streams that are overtopped by larger flow. The resultant characteristic of wide overbank flow within the existing and rapidly urbanizing areas produces a severe flooding problem. Overbank flow produced by a standard project flood, should it occur, would inundate an area of approximately 79 square miles, approximately 50 percent of which is occupied by urban development.

The Dreamy Draw, Cave Buttes, Adobe, and New River Dams comprise a flood control network which controls and reduces stormwater flow originating in the mountainous watershed north of the metropolitan Phoenix area. Controlled stormwater flows from the Dreamy Draw and Cave Buttes Dams are diverted, along with locally generated stormwater runoff, by the Arizona Canal Diversion Channel to Skunk Creek. Skunk Creek carries the stormwater to the New River, a tributary of the Agua Fria River. The Agua Fria River empties into the Gila River southwest of the City of Phoenix.

The study area of the Middle New River Master Plan lies below the New River Dam and within watersheds contributing runoff to the New River. Upstream of

the New River Dam, the New River watershed is comprised of 164 square miles of predominantly undeveloped desert and desert mountains. Downstream of the New River Dam, the New River watershed is highly urbanized. Stormwater flow below the New River Dam is conveyed as concentrated flow, within defined and braided channels, and as overland flow, within overbank areas of the New River.

Existing Channel Conditions

As previously stated, the nature and intensity of the development within and adjacent to the New River channel and floodplain varies significantly within 8.5 mile distance of the study area. Generally, the Middle New River Master Plan is concerned with the management of a channel whose characteristics have already been defined by intense development at its lower portion, whose characteristics are rapidly being defined by development along its mid-portion, and whose characteristics can be controlled ahead of development along its upper portion.

Reach 1 (Skunk Creek to Beardsley Road)

From the Skunk Creek confluence northward to the crossing of the Beardsley Road Alignment, the development within and adjoining the New River channel and floodplain is characterized as intense existing residential and commercial development. The New River channel through Reach 1 is characterized by a trapezoidal shaped section. The trapezoidal section is the result of encroachment of the natural channel/floodplain by development. The west channel side slopes of the New River through Reach 1 are typically armored with wire-tied rock gabions, however, the west channel side slopes through some segments of Reach 1 are armored with soil cement. Typically, the east channel side slopes of the New River through Reach 1 are unarmored. The channel bed material of the New River through Reach 1 is comprised of cobbles and sand.

A survey of biological resources within the Middle New River project area (R.A. Johnson, 1999) described the vegetation of Reach 1 as comprised of weedy

annual plant species that characterize disturbance and natural habitat limited to small remnant patches of terrace strand vegetation, dominated by scattered individuals of blue palo verde, within the 100-year floodplain. Johnson's survey identified one site, between Thunderbird Road and Bell Road, containing emergent vegetation (cattails) which appears to exist as a result of surface run-off channeled from an adjoining residential area. The cattails represent a sensitive habitat and mitigation may be required if their location is disturbed by any construction or maintenance activities associated with the channel or banks of the New River in Reach 1. No members of threatened or endangered species nor habitat conducive to their presence was identified in Reach 1.

Reach 1 is known to contain an historic archaeological site [AZ T:8:52 (ASM)] on the east bank of the river adjacent to the south side of Bell Road. This site is currently unprotected by channel armor and is subject to potential erosion and destruction by flooding. The addition of channel bank armor to protect the site from erosion requires disturbance of the site and archaeological mitigation of the site would be required prior to the installation of channel bank armor.

Reach 2 (Beardsley Road to Pinnacle Peak Road)

From the crossing of the Beardsley Road Alignment northward to the crossing of the Pinnacle Peak Road Alignment the land area within and adjoining the New River channel and floodplain is being developed intensely for residential and commercial use. The channel and channel slope characteristics of the New River through Reach 2 are similar to those through Reach 1. The channel section is trapezoidal in shape as a result of encroaching development. Its bed is comprised of sand and cobbles. However, the channel side slopes, with the exception of about 1500 feet along the west channel side, are unarmored. The 1500 feet of west channel side armor that exists through Reach 2 consists of wire-tied rock gabions.

As in Reach 1, Reach 2 vegetation is described by Johnson as comprised of weedy annual plant species that characterize disturbance and natural habitat limited to small remnant patches of terrace strand vegetation, dominated by scattered individuals of blue palo verde, within the 100-year floodplain. A small stand of Goodding willow exists south of Deer Valley Road within abandoned gravel pits. Mitigation of the Goodding willow is likely to be required if their location is disturbed by construction or maintenance activities associated with the channel or banks of the New River. No members of threatened or endangered species nor habitat conducive to their presence was identified in Reach 2.

No archaeological or cultural resource sites are known to exist within or adjacent to the channel of the New River in Reach 2.

Reach 3 (Pinnacle Peak Road to New River Dam)

With the exception of the Terramar residential development located on the east bank, the land area within and adjoining the channel and floodplain of the New River between the crossing of the Pinnacle Peak Road Alignment and the New River Dam is characterized as predominantly undeveloped. The channel is natural, braided in part, and is adjoined by overbank floodplain. The channel side slopes are unarmored, except where Terramar has installed wire-tied rock gabions and a concrete floodwall to protect its residential development, and the channel, side slopes, and floodplain areas are occupied by natural vegetation of varying density. The channel bed material through Reach 3 is comprised primarily of cobbles. Firm soil, coarse sand, and fine gravel comprise the floodplain and overbank areas.

Because it is predominantly undeveloped, Reach 3 was found by the biological resource survey (R.A. Johnson, 1999) to contain examples of three natural habitats: floodplain, terrace strand, and upland. The floodplain habitat occurs within the historic channel, the terrace strand habitat occurs along the margins of

the historic channel extending to the limit of the 100-year floodplain, and the upland habitat occurs outside the 100-year floodplain.

Vegetation of the floodplain habitat is dominated by cheesebush, burro brush, desert broom, sweet bush, and bur-sage. The terrace strand vegetative community in Reach 3 is dominated by blue palo verde, catclaw acacia, desert ironwood, and wolfberry. Western honey mesquite are present in the area immediately south of the New River Dam. The upland habitat of Reach 3 is characterized by creosote bush flats that grade laterally into creosote bush – bur-sage.

No examples of threatened or endangered species were observed in the natural areas of Reach 3, but small patches of saguaro cactus and mesquite near the New River Dam might provide marginal habitat for cactus ferruginous pygmy-owls. Any disturbance of the natural habitats of Reach 3 resulting from construction or maintenance activities associated with the New River channel or banks is likely to require mitigation.

A large and significant pre-historic archaeological site [AZ T:8:1 (ASU)] occupies the channel and the east bank of the New River north of the Terramar residential development. Mitigation of this archaeological site will be required in advance of any disturbance of its area by construction or maintenance activities associated with the channel or banks of the New River.

2. THE PREFERRED ALTERNATIVE

The selection of a preferred channel alternative for Middle New River was the result of consideration by the Steering Committee members of the various alternative evaluation parameters. These quantitative and qualitative parameters included: existing and future hydrology and hydraulics of the river, public comments, safety and aesthetics, social and environmental impacts, advantages and disadvantages, construction cost, existing infrastructure (bank armoring and bridges), and practicality of implementation. Paramount among these parameters was the ability of the proposed channel configurations to convey existing and projected 100-year flood flows within their confines.

The Watercourse Master Plan Preferred Alternative consists of the following elements:

- Reach 1 and Reach 2 (Skunk Creek Confluence to Pinnacle Peak Road): The existing earth channel bottom is maintained throughout Reaches 1 and 2. New channel bank improvements will consist of rock-filled wire mattresses for new bank armoring being proposed. The plan utilizes as much of the existing bank armoring as possible. It evaluates and protects existing bridges at Bell Road and Union Hills Road. Figure 2-1 is a typical section of the New River channel through Reaches 1 and 2 under the preferred alternative.

MIDDLE NEW RIVER WATERCOURSE MASTER PLAN

STRUCTURAL TYPE TRAPEZOIDAL SECTION

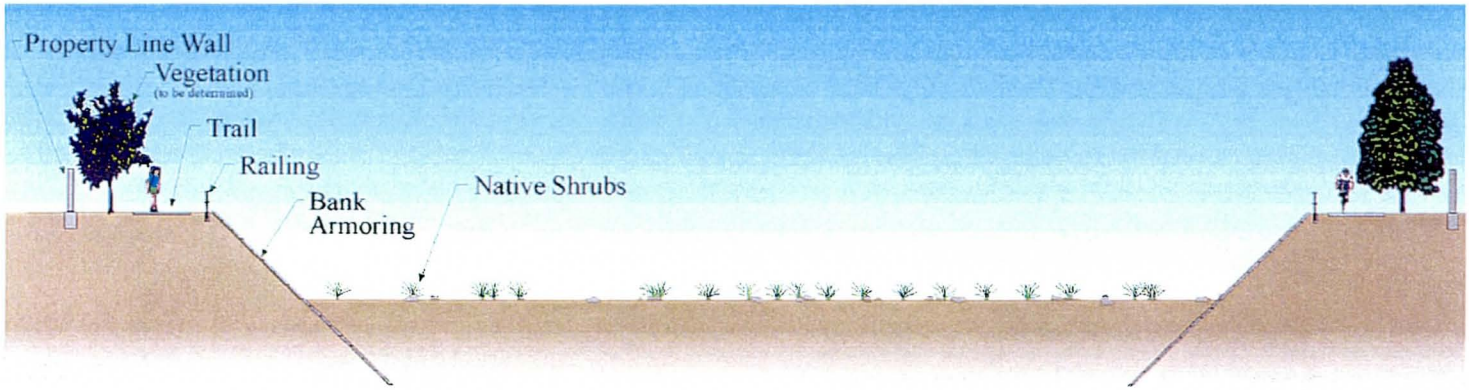

Figure 2-1:

Typical Channel Section for Reaches 1 and 2

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MIDDLE NEW RIVER WATERCOURSE MASTER PLAN
Flood Control District of Maricopa County

Typical Channel Sections

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- Reach 3 (Pinnacle Peak Road to New River Dam): An erosion setback buffer zone along the 100-year floodplain will prevent the future encroachment of residential and commercial development on the New River's channel and floodplain through Reach 3. The existing Terramar residential development and the bank armor and floodwall that have been installed to protect it will remain. Only minimal structural improvements are planned for the channel and banks of the New River through Reach 3. These planned improvements are limited to the construction of two low-flow, earthen pilot channels, one upstream and one downstream from Happy Valley Road. The purpose of the pilot channels is to redirect the main channel within the riverbed to arrest its lateral migration and alleviate the threat of erosion that it presents to existing development. A short section, approximately 700 lineal feet, of rock filled wire gabion is proposed for an out-parcel that boarders the Terramar residential development. The proposed gabion will not impact Waters of the U.S. Figure 2-2 is a typical section of the New River channel through Reach 3 under the preferred alternative.

Table 2-1 is a summary listing of improvements proposed under the preferred Master Plan alternative. The improvements summarized in the table are categorized in Improvement Segments that are referenced to the conceptual construction plans and associated river stations. Each segment is defined by the type and extent of the improvement. Master Plan improvements are limited to channel improvements only. Earthwork for channel improvements was estimated using a computer model. Property development improvements necessary adjacent to the channel were not evaluated. At locations where the proposed channel banks are to be filled, the banks are set with a fifteen foot top width, a 2:1 (horizontal/vertical) slope on the channel side, and a 4:1 side slope on the overbank side to tie to existing ground. It is inferred that overbank area will be reclaimed in the future by filling for development purposes.

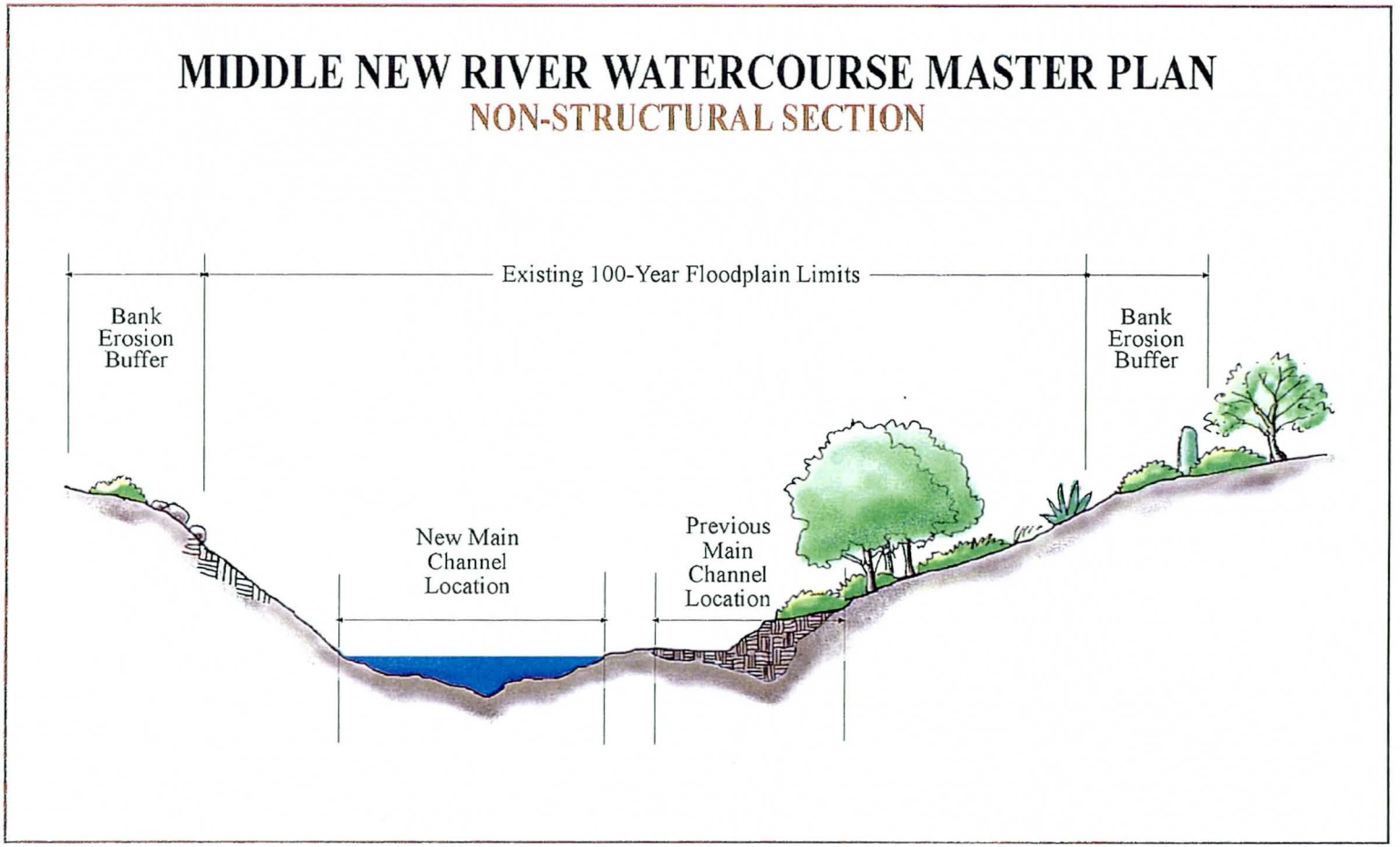

Figure 2-2:

Typical Channel Section for Reach 3

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Conceptual construction plans depicting the preferred alternative for each reach have been prepared at a scale of 1"=200'. The purpose of the plans is to present the intent of the proposed improvements and to aid in the development of construction cost estimates for the proposed improvements. The locations of existing channel features and proposed improvements depicted on the conceptual construction plans are approximate and are referenced to a construction line. The Conceptual Construction Plans for the Middle New River Watercourse Master Plan improvements are presented as Sheets 1 through 23 in Appendix A.

Table 2-1: Proposed Improvement Summary

Improvement Segment	Station (along construction line)	Proposed Improvements
1	26+30 to 55+00	Realign and grade east bank, provide rock-filled wire armoring. Minor earthwork within channel.
2	61+50 to 69+50	Realign and grade west bank, provide rock-filled wire armoring. Minor earthwork within channel.
3	78+50 to 86+50	Realign and grade east bank, provide rock-filled wire armoring. Minor earthwork within channel.
4	88+50 to 140+90	Realign and grade east bank, provide rock-filled wire armoring. Minor earthwork within channel from stations 88+50 to 109+00. Channel excavation from stations 109+00 to 133+00 and 136+00 to 140+90. Provide grade control structure and river bottom access/maintenance ramp at Station 133+00.
5	144+80 to 159+50	Realign and grade west bank, provide rock-filled wire armoring. Minor earthwork within channel.
6	159+50 to 314+00	Realign and grade east and west banks, provide rock-filled wire armoring, excavate channel. Provide grade control structure and river bottom access/maintenance ramp at Stations 258+18 (by others) and 311+00.
7	314+00 to 460+00	Erosion setback limits are utilized to define development limits. Installation of wing walls and collector channels at Station 315+00. Excavate pilot channel at Station 345+00 to Station 370+00, backfill and revegetate. Excavate pilot channel at Station 382+00 to Station 412+00, backfill and revegetate. Provide rock-filled wire armoring (east bank only) at Station 376+00 to Station 384+00.

3. PRELIMINARY CHANNEL ALTERNATIVES

The Preferred Alternative, discussed in Chapter 2, combines a structural alternative in Reaches 1 and 2 with a non-structural alternative in Reach 3. This chapter presents the structural and non-structural alternatives considered for each of the reaches as well as the No-Action alternative.

An engineering analysis of the Middle New River was conducted to define the flow capacity adequate to contain the 100-year flood within the average existing FEMA floodway for each subject reach. The engineering analysis identified six preliminary channel development alternatives that could be utilized within each of the three reach areas of New River. The six preliminary alternatives can be further defined as either structural or non-structural in nature. Structural alternatives require significant physical modification of the New River channel and banks to define and contain the channel within a restricted area in order to protect existing development and infrastructure from damage resulting from flood events. Non-structural alternatives prevent or eliminate development within the channel and floodplain area as well as erosion buffer zones in order to maintain or create a natural channel that does not threaten existing or future development with flood damage potential.

No Action Alternative

Under the No Action Alternative, the development within and adjacent to the channel and floodplain of the New River between Skunk Creek and the New River Dam is not uniformly regulated and controlled. The existing conditions of Reach 1 and the New River channel below Skunk Creek reflect the results of the No Action Alternative. Channel side armor is uneven and of different construction and this condition is likely to be extended northward. The result is an uneven visual impact, increased maintenance costs resulting from the need to maintain multiple types of materials, limited access for recreational use, and

possible increase in flood damage potential to the unprotected channel sides as a result of preferential erosion.

Through Reach 1 and below, the natural floodplain and overbank areas of the New River have been occupied for residential and commercial use, resulting in constriction of the New River meander belt and an increase in runoff within the New River watershed. This condition is currently being extended northward through Reach 2 and is likely to progress through Reach 3 unless development restrictions are enacted and enforced.

Preliminary Channel Alternatives

Alternative 1 – Trapezoidal Channel, Soil Cement Bank Armor

Channel Alternative 1 is a structural channel alternative. It provides for a trapezoidal channel section with a natural channel bed. The channel side slopes are armored with soil cement. As required, this channel accommodates projected Corps of Engineers flood flows while protecting existing and proposed development within the floodplain and adjoining area from flood erosion. The natural channel bed permits the establishment of natural vegetation within the channel and allows for percolation, as recharge, of floodwater to the subsurface. Soil cement armoring of the channel sides prevents the establishment of any vegetation on the channel sides. Figure 2-1 is a sectional representation of this channel alternative.

Alternative 2 – Trapezoidal Channel, Rock Gabion Bank Armor

Channel Alternative 2 is a structural channel alternative. It provides for a trapezoidal channel section with a natural channel bed. The channel side slopes are armored with wire-tied gabion mattresses. As required, this channel accommodates projected Corps of Engineers flood flows while protecting existing and proposed development within the floodplain and adjoining area from flood erosion. The natural channel bed permits the establishment of natural vegetation within the channel and allows for percolation, as recharge, of floodwater to the

subsurface. The gabion mattress channel side armoring permits the establishment of some forms of natural vegetation along the channel sides. Figure 2-1 is a sectional representation of this channel alternative.

Alternative 3 – Trapezoidal Channel, Landscape Enhancement

Channel Alternative 3 is a structural channel alternative. It provides for a trapezoidal channel, the flow capacity of which is reduced by landscape enhancement but still fulfills the Corps of Engineers flood capacity requirements. Elements of this alternative are a uniform, natural channel bed and bank armoring comprised of wire-tied gabion mattresses. The gabion mattress bank armor is covered by a soil blanket of sufficient thickness to provide a bed for more extensive establishment of a wide range of natural vegetation species. The uniform, natural channel bed permits the establishment of natural vegetation within the channel and allows for percolation, as recharge, of floodwater to the subsurface. Figure 3-1 is a sectional representation of this channel alternative.

Alternative 4 – Trapezoidal Channel, Trail Bench

Channel Alternative 4 is a structural channel alternative. It provides for a modified trapezoidal channel section with a natural channel bed and a trail bench. The trail bench occupies one or both channel sides. The channel side slopes are armored with soil cement. As required, this channel accommodates projected Corps of Engineers flood flows while protecting existing and proposed development within the floodplain and adjoining area from flood erosion. The natural channel bed permits the establishment of natural vegetation within the channel and allows for percolation, as recharge, of floodwater to the subsurface. Soil cement channel side armoring prevents the establishment of any vegetation along the channel sides. Figure 3-2 is a sectional representation of this channel alternative.

MIDDLE NEW RIVER WATERCOURSE MASTER PLAN

STRUCTURAL TYPE TRAPEZOIDAL SECTION WITH LANDSCAPE ENHANCEMENT

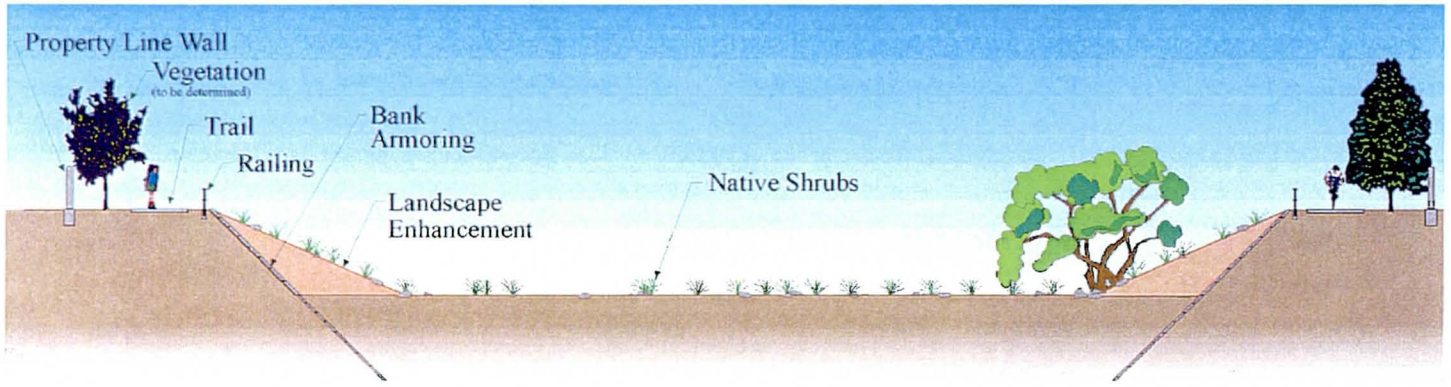

Figure 3-1:

Typical Channel Section for Alternative 3

MIDDLE NEW RIVER WATERCOURSE MASTER PLAN

STRUCTURAL TYPE TRAPEZOIDAL SECTION WITH TRAIL BENCH

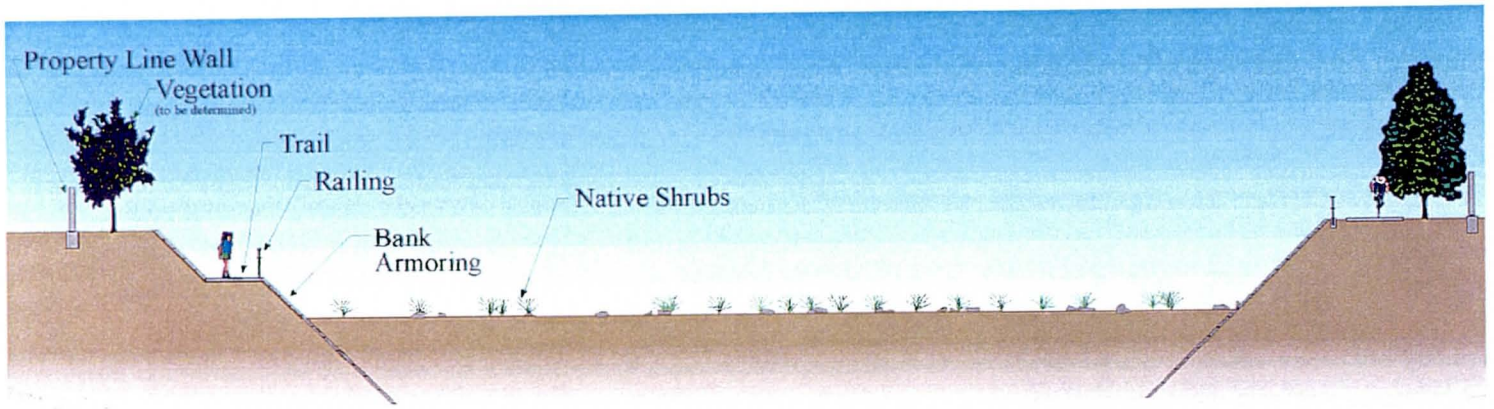

Figure 3-2:

Typical Channel Section for Alternative 4

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Alternative 5 – Narrow Trapezoidal Channel, Broad Overbank

Channel Alternative 5 is a structural channel alternative. It provides for a narrow, defined trapezoidal channel, the side slopes of which are armored with gabion mattresses, with a natural channel bed. The narrow channel is adjoined by a broad overbank area upon which natural and introduced vegetation would be encouraged to develop. Minor flood flows would be accommodated within the narrow armored channel. The broad overbank would accommodate flood flows by spreading flow volume across the open overbank belt area. The overbank area is suitable for development of passive recreational facilities and trails which are susceptible to obliteration by major flood events. Figure 3-3 is a sectional representation of this channel alternative.

Alternative 6 – Natural Channel and Floodplain, Erosion Buffer

Channel Alternative 6 is a non-structural alternative. The elements of this alternative are a natural channel with enhanced flow capacity created by excavation at some selected locations. Under this alternative, the channel slopes are not armored. Floodplain and overbank areas remain undeveloped and are adjoined by undeveloped erosion buffer zones which protect adjoining development while permitting the watercourse to migrate naturally within its anticipated meander belt. Existing natural vegetation and wildlife remains largely undisturbed under this alternative. Flood events are easily accommodated by the natural channel, floodplain, and overbank area with no threat to adjoining development. Little maintenance is required. The natural channel bed and floodplain permits percolation of floodwater as recharge. The broad natural area of the undeveloped meander belt is suitable for recreational use and wildlife habitat. Figure 2-2 is a typical channel section for Alternative 6.

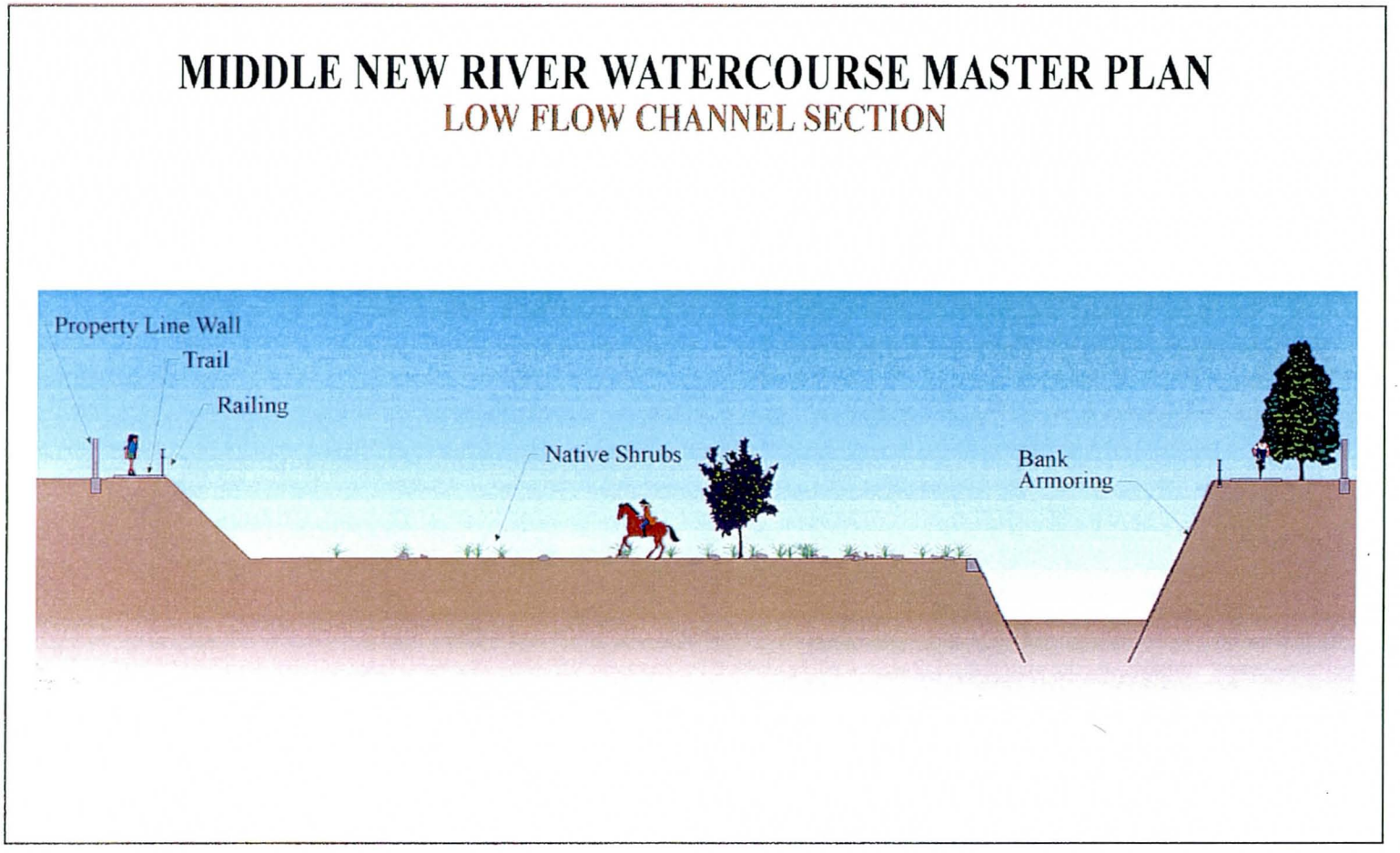


Figure 3-3:

Typical Channel Section for Alternative 5

Preferred Alternative

The Preferred Alternative for the management of the New River between Skunk Creek and the New River Dam combines Alternative 2 for Reaches 1 and 2 and Alternative 6 for Reach 3. The remaining chapters of this Alternatives Analysis Report provide a comparison of the impacts of each of the alternatives on the existing channel and surrounding area environmental conditions and the rationale for the selection of the Preferred Alternative by the public and the Steering Committee.

4. ENVIRONMENTAL CONSIDERATIONS

The environmental considerations of each of the alternatives for the management of the Middle New River Watercourse are presented in this chapter. The environmental consequences of several of the alternatives are the same or similar and this aspect has had the effect of shifting the basis for the selection of a preferred alternative from its environmental impact to another basis such as relative cost or social-economic impact.

No Action Alternative

Under the No Action Alternative the type of floodplain and channel development typical of the New River below Skunk Creek and through Reach 1 is propagated northward through Reach 2 and Reach 3 to the New River Dam. This development is characterized by constriction of the New River's natural meander belt by residential and commercial construction within the floodplain to the channel margins. Potential and actual wildlife habitat is lost to development.

Construction and paving in the floodplain increases runoff and reduces available area for the percolation of floodwater and aquifer recharge.

Individual developers and property owners determine whether their properties are protected by bank armor and the type of armor installed, if any. The result is a patchwork of bank armor types with gaps where no armor is present. This distribution of bank armoring materials and construction styles presents an uneven and unappealing visual aspect.

Access to the channel for maintenance and repair of bank armor and bridges is limited or non-existent. Removal of trash accumulations within the river channel is made more difficult as is the care and maintenance of any natural vegetation within the channel.

Preliminary Channel Alternatives

Alternative 1 – Trapezoidal Channel, Soil Cement Bank Armor

This alternative represents a continuation of the floodplain development and channel constriction typical of the New River below Skunk Creek northward through Reaches 1, 2, and 3 to the New River Dam. It provides for controlled access to the channel for maintenance of the channel and the channel bank armor. The visual effect of soil cement bank armor is that of a smooth, even-textured wall. Soil cement bank armor does not permit the establishment of any vegetation on the channel banks nor is it as permeable as other methods of bank protection to the percolation of water to the subsurface. Public comments concerning this alternative have been negative, generally describing the visual aspect as sterile. Flat soil cement bank armor is an attractive target for defacement by "taggers" and graffiti artists.

This method of structural channel control would have little environmental impact if adopted for Reaches 1 and 2, but application of Alternative 1 channel control through Reach 3 to the New River Dam would result in a net loss of natural floodplain habitat and an increase in runoff in the New River watershed.

Alternative 2 – Trapezoidal Channel, Rock Gabion Bank Armor

Like Alternative 1, this alternative represents a continuation of the floodplain development and channel constriction typical of the lower New River through Reaches 1, 2, and 3. Like Alternative 1, it provides for controlled access to the channel for maintenance of the channel and the channel bank armor. Unlike Alternative 1, rock gabion bank armor permits the establishment of certain varieties of natural volunteer vegetation on the channel banks. It also provides a rougher, less sterile visual aspect because of the variety of rock colors and sizes contained within the gabions.

Like Alternative 1, Alternative 2 would result in little environmental impact if applied to Reaches 1 and 2. It would also result in a net loss of floodplain habitat

in Reach 3, but it is more favorable for the establishment of natural vegetation on protected channel banks than is soil cement. Rock gabions are more permeable than soil cement for the percolation of surface water to the subsurface and are therefor preferable for aquifer recharge.

Alternative 3 – Trapezoidal Channel, Landscape Enhancement

This alternative, if applied to Reach 1 and 2 would enhance the visual appearance of the New River channel by encouraging the establishment of vegetation within the channel and along the armored channel sides. The addition of soil covering the rock gabions would result in a reduction of channel volume thereby marginally reducing the capacity of the channel to transport floodwater. Significant disturbance of the channel would be required to install the landscape enhancements. The landscape materials and plants would require regular maintenance, thereby requiring additional and more frequent disturbance of the river channel by maintenance personnel. It is likely that the landscaping and the soil supporting it would be swept away by a major flood event and additional expense and channel disturbance would be required to replace it.

If applied to Reach 3 of the New River, this alternative would result in a net loss of floodplain habitat and significant disturbance of the channel during the landscape installation.

Alternative 4 – Trapezoidal Channel, Trail Bench

The application of Alternative 4 to Reaches 1 and 2 of the New River would require the modification of existing channel bank armor thereby marginally increasing the channel disturbance associated with the installation of bank armor throughout Reaches 1 and 2. The presence of the trail bench does not constitute any kind of habitat improvement or mitigation while it adds additional maintenance that might also require channel disturbance.

Alternative 4 utilizes soil cement as its form of bank armor and it would therefore, create the same types of negative impacts associated with Alternative 1,

including increased accessibility to defacement by graffiti artists provided by the trail bench.

The application of Alternative 4 to Reach 3 would result in a net loss of floodplain habitat and significant channel disturbance during the installation of the channel bank armor and the trail bench.

Alternative 5 – Narrow Trapezoidal Channel, Broad Overbank

The application of Alternative 5 to Reaches 1, 2, and 3 would require significant disturbance of the existing New River channel to establish the narrow channel and install its bank armor. Significant channel disturbance would also be necessary following major floods to remove sediment and reestablish the narrow channel. The application of Alternative 5 to Reach 3, as with the other structural channel control alternatives, would result in a net loss of floodplain habitat.

Alternative 6 – Natural Channel and Floodplain, Erosion Buffer

Alternative 6 is impractical for application to Reaches 1 and 2. The removal of existing development and bank armor would be required to permit the New River to reestablish its natural channel and floodplain. Bridges would need to be lengthened to accommodate the broader flow regime of the natural channel in flood. Additional demolition would be required to provide the erosion buffer contemplated by this alternative.

In Reach 3, Alternative 6 is the least environmentally destructive alternative. It utilizes existing undeveloped floodplain and erosion buffer to protect the natural channel from encroachment and constriction resulting from floodplain development. Some channel disturbance will be required to enhance the flow capacity of the natural channel to accommodate floodwater. If, as a result of flooding and natural channel migration, it appears that the channel of the New River will transgress the limits of the erosion buffer, it may be necessary to modify the channel in order to reestablish it within the broad natural corridor that its current floodplain and the contemplated erosion buffer provide.

Preferred Alternative

The Preferred Alternative combines Alternatives 2 and 6. Alternative 2 is applied to Reaches 1 and 2 where existing development has already encroached upon the New River's channel and floodplain. Alternative 6 is applied to Reach 3 where the channel and floodplain have not been significantly impacted by development and where there is enough undeveloped adjoining land to permit the establishment of the erosion buffer zone flanking the floodplain.

In Reaches 1 and 2, the approach is to minimize the disturbance of the New River channel and the environment even with the application of a structural alternative. Engineering analyses indicate that the river has the potential to preferentially scour unprotected channel banks and migrate laterally. Rock-filled wire bank armoring is proposed to mitigate the potential lateral migration of the channel bed in Reaches 1 and 2. Engineering analyses also indicate that the New River channel bed is in transition and will degrade, or erode downward, over time. The primary cause of the degradation and the potential for enhanced lateral migration is that the natural sediment supply to New River has been cut off since the construction of New River Dam. Because of this, several grade control structures are proposed at selected locations in the New River. Only minimal channel bed grading will be conducted during construction in Reaches 1 and 2 to create and maintain the necessary flood conveyance capacity. The river will complete the remainder of the work of establishing a final grade by naturally eroding and degrading the channel bed over time.

The primary purpose of the bank armoring and grade control structures in Reaches 1 and 2 is to stabilize the channel to protect existing infrastructure and provide public safety. Several locations considered at risk of lateral erosion and that warrant bank armoring are:

- The Hillcrest Subdivision located on the east bank of the New River between Pinnacle Peak Road and Deer Valley Road. The channel bank of New River adjacent to the subdivision is not currently armored. Engineering analysis indicates potential lateral erosion into the subdivision if unchecked. Recent aerial photographs and field reconnaissance of the area north of the subdivision indicate channel erosion confirming this prediction and trend.

- The channel banks of New River between Pinnacle Peak Road and Deer Valley Road. These banks are currently unprotected. Engineering analysis of the river's channel indicates potential lateral erosion to the west if unchecked. The lateral erosion and vertical degradation of the New River channel are being encouraged by the mining of sand and gravel at an active pit located on the west bank near Pinnacle Peak Road. The Fletcher Heights Subdivision, also located on the west bank and adjacent to the south of the sand and gravel pit, is threatened by stormwater runoff from New River and Rock Springs Creek, a small tributary to the west. The runoff has the potential to overtop the sand and gravel pit, flooding the area between New River and 83rd Avenue occupied by the Fletcher Heights Subdivision. A new bridge, river grade control structure and roadway improvements are presently being designed for the Deer Valley Road crossing of the New River by the Maricopa County Department of Transportation (these improvements will be addressed in separate a 404 Permit Application by others). The planned Deer Valley Road bridge, river grade control structure, and roadway improvements will be at risk without the proposed bank stabilization to direct flood flows and prevent erosion.

- The channel bed south of Deer Valley Road. At this location the New River channel currently drops abruptly (approximately 12 feet) and, except for the Fletcher Heights Subdivision located on the west bank near the Beardsley Road alignment, does not have channel bank armor. Various existing and proposed commercial and residential structures are located on both sides of the channel between Deer Valley Road and Beardsley Road. Engineering analysis indicates that these structures are threatened by potential unchecked lateral erosion in this reach. The proposed bridge and grade control structure at Deer

Valley Road will discharge stormwater at velocities that require bank armoring to the south. Preferential lateral erosion occurs when one bank is armored and the other is not, as is the case adjacent to the Fletcher Heights Subdivision. It is necessary to armor both banks to prevent preferential lateral erosion.

In Reach 1 (Skunk Creek to Beardsley Road), portions of the east and west banks will be graded and realigned. Rock-filled wire bank armoring will be installed on the east and west banks where there is currently no bank armoring. From a point approximately 2100 feet north of Bell Road to a point approximately 800 feet south of Union Hills Drive the channel of New River will be excavated and graded to increase its capacity. A grade control structure and river bottom access ramp will be installed approximately 900 feet south of Union Hills Drive. From a point approximately 500 feet south of Union Hills Drive to approximately Union Hills Drive, the New River channel will be excavated and graded to increase its capacity. From a point approximately 1800 feet north of Union Hills Drive to Beardsley Road, the west bank and a portion of the east bank will be realigned, graded, and armored with rock-filled wire gabions.

In Reach 2 (Beardsley Road to Pinnacle Peak Road), the east and west banks will be realigned, graded, and armored with rock-filled gabions. The channel will be excavated and graded to increase its capacity. Grade control/river bottom access structures will be installed at Deer Valley Road and Pinnacle Peak Road.

In Reach 3, erosion buffer zones will be established and development restricted to protect the existing natural channel and floodplain. Two short segments of the New River channel (at bends caused by lateral migration) will be modified by the installation of low flow, pilot channels (relocated and dredged, if necessary) to provide capacity necessary to efficiently convey floodwater.

In all reaches, natural vegetation will be permitted to reestablish itself within the New River channel and the channel bank armoring after the proposed modifications have been made.

5. COMPARISON OF ALTERNATIVES

To illustrate the rationale for the selection of the preferred alternative by the public and the Steering Committee, matrices containing the comparative impacts and costs of each of the alternatives for each of the reaches have been prepared. The matrices follow as Tables 5-1 (Reach 1), 5-2 (Reach 2), and 5-3 (Reach 3).

Reach 1 (Skunk Creek to Beardsley Road)

Table 5-1: Alternatives Impact and Cost Comparison - Reach 1

Alternative	Impact to U.S. Waters	Habitat Impact	Archaeological/ Cultural Resources Impact	Visual Impact	Safety	Estimated Construction Cost in Millions of Dollars/Mile
1	• 6940 feet of channel excavation • 7990 feet of minor earthwork within channel • 1 grade control structure • 1 river bottom access/ maintenance ramp.	• Natural channel is confined between armored banks. • Reestablishment of natural vegetation encouraged in channel. • Soil cement bank armor prevents reestablishment of natural vegetation on banks.	• Mitigation of archaeological site on east bank south of Bell Road required prior to bank armor construction.	• Soil cement bank armor is "sterile" in appearance. • Soil cement bank armor prevents revegetation of banks. • Soil cement bank armor provides target for defacement by graffiti artists.	• Corps of Engrs. 100-year flood is accommodated. • Existing and future infrastructure and bank development are protected. • Lateral stream channel migration is controlled. • Public safety is enhanced.	$3.24M
2 (Preferred)	• 6940 feet of channel excavation. • 7990 feet of minor earthwork within channel. • 1 grade control structure. • 1 river bottom access/ maintenance ramp.	• Natural channel is confined between armored banks. • Reestablishment of natural vegetation encouraged in channel. • Some varieties of natural vegetation will	• Mitigation of archaeological site on east bank south of Bell Road required prior to bank armor construction.	• Rock gabion armor provides visual texture. • Natural vegetation reestablished on banks provides natural contrast and breaks up monotony of bank armor.	• Corps of Engrs. 100-year flood is accommodated. • Existing and future infrastructure and bank development are protected. • Lateral stream channel migration is controlled.	$2.45M

Alternative	Impact to U.S. Waters	Habitat Impact	Archaeological/ Cultural Resources Impact	Visual Impact	Safety	Estimated Construction Cost in Millions of Dollars/Mile
		reestablish on banks.			• Public safety is enhanced.	
3	• 6940 feet of channel excavation. • 7990 feet of minor earthwork within channel. • 1 grade control structure. • 1 river bottom access/ maintenance ramp. • Landscape enhancement requires addition of fill to the existing New River channel.	• Natural channel is confined between armored banks. • Landscape enhancement of channel results in more diverse natural vegetation community. • Rock gabion bank armor with landscape enhancement results in denser and more diverse natural vegetation on banks.	• Mitigation of archaeological site on east bank south of Bell Road required prior to bank armor construction.	• Denser covering of natural vegetation on banks provides natural appearance.	• Corps of Engrs. 100-year flood is accommodated. • Existing and future infrastructure and bank development are protected. • Lateral stream channel migration is controlled. • Public safety is enhanced.	$4.53M
4	• 6940 feet of channel excavation • 7990 feet of minor earthwork within channel • 1 grade control structure • 1 river bottom access/ maintenance ramp	• Natural channel is confined between armored banks. • Reestablishment of natural vegetation encouraged in channel. • Soil cement bank armor prevents	• Mitigation of archaeological site on east bank south of Bell Road required prior to bank armor construction.	• Soil cement bank armor is "sterile" in appearance. • Soil cement bank armor prevents revegetation of banks. • Soil cement bank armor provides target for	• Corps of Engrs. 100-year flood is accommodated. • Existing and future infrastructure and bank development are protected. • Lateral stream channel migration is controlled.	$4.12M

Alternative	Impact to U.S. Waters	Habitat Impact	Archaeological/ Cultural Resources Impact	Visual Impact	Safety	Estimated Construction Cost in Millions of Dollars/Mile
		reestablishment of natural vegetation on banks.		defacement by graffiti artists.	• Public safety is enhanced.	
5	• 17,370 feet of excavation and channelization • 1 grade control structure • 1 river bottom access/ maintenance ramp	• Desert wash habitat is reduced to narrow channel with more frequent inundation. • Majority of existing channel habitat is converted to floodplain habitat but is subject to devastation by flood events.	• Mitigation of archaeological site on east bank south of Bell Road required prior to bank armor construction.	• Natural overbank/ floodplain area and unprotected slope opposite low-flow channel subject to occupation by natural vegetation results in more natural visual aspect.	• Corps of Engrs. 100-year flood is accommodated. • Possible erosion of unprotected bank opposite low-flow channel during major flood. • Low flow stream channel subject to siltation and/or abandonment during major flood. • Public safety is enhanced.	$2.72M
6	N/A	N/A	N/A	N/A	N/A	N/A
No Action	No Impact	No Impact	• Historic archaeological site vulnerable to flood damage.	• Patchwork impact of diverse types of bank armoring and absence of armoring.	• Corps of Engrs. 100-year flood is not accommodated. • Existing and future infrastructure and bank development are not protected. • Lateral stream	$0

Alternative	Impact to U.S. Waters	Habitat Impact	Archaeological/ Cultural Resources Impact	Visual Impact	Safety	Estimated Construction Cost in Millions of Dollars/Mile
					channel migration is not controlled. • Public safety is placed at high risk.	

Reach 2 (Beardsley Road to Pinnacle Peak Road)

Table 5-2: Alternatives Impact and Cost Comparison - Reach 2

Alternative	Impact to U.S. Waters	Habitat Impact	Archaeological/ Cultural Resources Impact	Visual Impact	Safety	Estimated Construction Cost in Millions of Dollars/Mile
1	• 11,400 feet of channel excavation. • 2 grade control structures. • 2 river bottom access/ maintenance ramps	• Currently undeveloped floodplain developed for commercial and residential use. • Natural channel is confined between armored banks. • Reestablishment of natural vegetation encouraged in channel. • Soil cement bank armor prevents reestablishment of natural vegetation on banks. • Mitigation of Gooddings willows in abandoned pits.	• None	• Soil cement bank armor is "sterile" in appearance. • Soil cement bank armor prevents revegetation of banks. • Soil cement bank armor provides target for defacement by graffiti artists.	• Corps of Engrs. 100-year flood is accommodated. • Existing and future infrastructure and bank development are protected. • Lateral stream channel migration is controlled. • Public safety is enhanced.	$4.20M
2 (Preferred)	• 11,400 feet of channel excavation.	• Currently undeveloped floodplain	• None	• Rock gabion armor provides visual texture.	• Corps of Engrs. 100-year flood is	$3.39M

Alternative	Impact to U.S. Waters	Habitat Impact	Archaeological/ Cultural Resources Impact	Visual Impact	Safety	Estimated Construction Cost in Millions of Dollars/Mile
	• 2 grade control structures. • 2 river bottom access/ maintenance ramps	developed for commercial and residential use. • Natural channel is confined between armored banks. • Reestablishment of natural vegetation encouraged in channel. • Rock gabion bank armor permits reestablishment of natural vegetation on banks. • Mitigation of Gooddings willows in abandoned pits.		• Natural vegetation reestablished on banks provides natural contrast and breaks up monotony of bank armor.	accommodated. • Existing infrastructure and bank development is protected. • Lateral stream channel migration is controlled. • Public safety is enhanced.	
3	• 11,400 feet of channel excavation. • 2 grade control structures. • 2 river bottom access/ maintenance ramps	• Currently undeveloped floodplain developed. • Natural channel is confined between armored banks. • Landscape enhancement of channel results in	• None	• Denser covering of natural vegetation on banks provides natural appearance.	• Corps of Engrs. 100-year flood is accommodated. • Existing infrastructure and bank development is protected. • Lateral stream channel migration is controlled.	$4.08

Alternative	Impact to U.S. Waters	Habitat Impact	Archaeological/ Cultural Resources Impact	Visual Impact	Safety	Estimated Construction Cost in Millions of Dollars/Mile
		more diverse natural vegetation community. • Rock gabion bank armor with landscape enhancement results in denser and more diverse natural vegetation on banks. • Mitigation of Gooddings willows in abandoned pits.			• Public safety is enhanced.	
4	• 11,400 feet of channel excavation. • 2 grade control structures. • 2 river bottom access/ maintenance ramps	• Currently undeveloped floodplain developed. • Natural channel is confined between armored banks. • Reestablishment of natural vegetation encouraged in channel. • Soil cement bank armor prevents reestablishment of natural vegetation	• None	• Soil cement bank armor is "sterile" in appearance. • Soil cement bank armor prevents revegetation of banks. • Soil cement bank armor provides target for defacement by graffiti artists.	• Corps of Engrs. 100-year flood is accommodated. • Existing and future infrastructure and bank development is protected. • Lateral stream channel migration is controlled. • Public safety is enhanced.	$4.44M

Alternative	Impact to U.S. Waters	Habitat Impact	Archaeological/ Cultural Resources Impact	Visual Impact	Safety	Estimated Construction Cost in Millions of Dollars/Mile
		on banks. • Mitigation of Gooddings willows in abandoned pits.				
5	• 11,400 feet of channel excavation. • 2 grade control structures. • 2 river bottom access/ maintenance ramps	• Existing floodplain habitat is replaced by commercial and residential development. • Desert wash habitat is reduced to narrow channel with more frequent inundation. • Majority of existing channel habitat is converted to floodplain habitat but is subject to devastation by flood events. • Mitigation of Gooddings willows in abandoned pits.	• None	• Natural overbank/ floodplain area and unprotected slope opposite low-flow channel subject to occupation by natural vegetation results in more natural visual aspect.	• Corps of Engrs. 100-year flood is accommodated. • Existing infrastructure and bank development is protected. • Lateral stream channel migration is controlled. • Public safety is enhanced.	$2.72M
6	N/A	N/A	N/A	N/A	N/A	N/A
No Action	No Impact	• Existing floodplain habitat is replaced by commercial and residential	No Impact	• Uneven patchwork of bank armoring and unprotected banks.	• Corps of Engrs. 100-year flood is not accommodated. • Existing	$0

Alternative	Impact to U.S. Waters	Habitat Impact	Archaeological/ Cultural Resources Impact	Visual Impact	Safety	Estimated Construction Cost in Millions of Dollars/Mile
		development.			infrastructure and bank development is not protected. • Lateral stream channel migration is not controlled. • Public safety is placed at high risk.	

Reach 3 (Pinnacle Peak Road to New River Dam)

Table 5-3: Alternatives Impact and Cost Comparison - Reach 3

Alternative	Impact to U.S. Waters	Habitat Impact	Archaeological/ Cultural Resources Impact	Visual Impact	Safety	Estimated Construction Cost in Millions of Dollars/Mile
1	• 14,600 feet of channel excavation and grading.	• Currently undeveloped floodplain developed for commercial and residential use. • Natural channel is confined between armored banks. • Reestablishment of natural vegetation encouraged in channel. • Soil cement bank armor prevents reestablishment of natural vegetation on banks.	• Mitigation of Palo Verde archaeological site required prior to any disturbance of channel or bank within the site area.	• Soil cement bank armor is "sterile" in appearance. • Soil cement bank armor prevents revegetation of banks. • Soil cement bank armor provides target for defacement by graffiti artists.	• Corps of Engrs. 100-year flood is accommodated. • Existing and future infrastructure and bank development are protected. • Lateral stream channel migration is controlled. • Public safety is enhanced.	$2.68M
2	• 14,600 feet of channel excavation and grading.	• Currently undeveloped floodplain developed for commercial and residential use.	• Mitigation of Palo Verde archaeological site required prior to any disturbance of channel or bank	• Rock gabion armor provides visual texture. • Natural vegetation reestablished on	• Corps of Engrs. 100-year flood is accommodated. • Existing and future	$1.75M

Alternative	Impact to U.S. Waters	Habitat Impact	Archaeological/ Cultural Resources Impact	Visual Impact	Safety	Estimated Construction Cost in Millions of Dollars/Mile
		• Natural channel is confined between armored banks. • Reestablishment of natural vegetation encouraged in channel. • Rock gabion bank armor permits reestablishment of natural vegetation on banks.	within the site area.	banks provides natural contrast and breaks up monotony of bank armor.	infrastructure and bank development are protected. • Lateral stream channel migration is controlled. • Public safety is enhanced.	
3	• 14,600 feet of channel excavation and grading.	• Currently undeveloped floodplain developed. • Natural channel is confined between armored banks. • Landscape enhancement of channel results in more diverse natural vegetation community. • Rock gabion bank armor with landscape	• Mitigation of Palo Verde archaeological site required prior to any disturbance of channel or bank within the site area.	• Denser covering of natural vegetation on banks provides natural appearance.	• Corps of Engrs. 100-year flood is accommodated. • Existing and future infrastructure and bank development is protected. • Lateral stream channel migration is controlled. • Public safety is enhanced.	$2.85M

Alternative	Impact to U.S. Waters	Habitat Impact	Archaeological/ Cultural Resources Impact	Visual Impact	Safety	Estimated Construction Cost in Millions of Dollars/Mile
		enhancement results in denser and more diverse natural vegetation on banks.				
4	• 14,600 feet of channel excavation and grading.	• Currently undeveloped floodplain developed for commercial and residential use. • Natural channel is confined between armored banks. • Reestablishment of natural vegetation encouraged in channel. • Soil cement bank armor prevents reestablishment of natural vegetation on banks.	• Mitigation of Palo Verde archaeological site required prior to any disturbance of channel or bank within the site area.	• Soil cement bank armor is "sterile" in appearance. • Soil cement bank armor prevents revegetation of banks. • Soil cement bank armor provides target for defacement by graffiti artists.	• Corps of Engrs. 100-year flood is accommodated. • Existing and future infrastructure and bank development is protected. • Lateral stream channel migration is controlled. • Public safety is enhanced.	$3.52M
5	• 14,600 feet of channel excavation and grading.	• Existing floodplain habitat is replaced by commercial and residential development.	• Mitigation of Palo Verde archaeological site required prior to any disturbance of channel or bank	• Natural overbank/floodplain area and unprotected slope opposite low-flow channel subject to	• Corps of Engrs. 100-year flood is accommodated. • Existing and future	$1.99M

Alternative	Impact to U.S. Waters	Habitat Impact	Archaeological/ Cultural Resources Impact	Visual Impact	Safety	Estimated Construction Cost in Millions of Dollars/Mile
		• Desert wash habitat is reduced to narrow channel with more frequent inundation. • Majority of existing channel habitat is converted to floodplain habitat but is subject to devastation by flood events.	within the site area.	occupation by natural vegetation results in more natural visual aspect.	infrastructure and bank development is protected. • Lateral stream channel migration is controlled. • Public safety is enhanced.	
6 (Preferred)	• 5000 feet of channel excavation and backfill (500 feet at Pinnacle Peak Rd., 2000 feet downstream from Happy Valley Rd., and 2500 feet upstream from Happy Valley Rd.) • 2250 feet of wing wall at Pinnacle Peak Rd. • 700 feet of bank armor at Terramar development.	• Minimal impacts to habitat only where disturbance is necessary to enhance channel and/or armor banks in bends. • Erosion buffer protects floodplain and channel from encroachment.	• Mitigation of Palo Verde archaeological site required prior to any disturbance of channel or bank within the site area.	• Visual aspects of natural upland desert wash and floodplain are maintained.	• Corps of Engrs. 100-year flood is accommodated. • No development on banks and floodplain threatened by flood. • Natural stream channel migration is permitted within meander belt but monitored and corrected if migration into buffer zone	$0.52M

Alternative	Impact to U.S. Waters	Habitat Impact	Archaeological/ Cultural Resources Impact	Visual Impact	Safety	Estimated Construction Cost in Millions of Dollars/Mile
					occurs. • Public safety is enhanced.	
No Action	• Possible impacts as individual developers maximize use of land area adjoining New River channel.	• Existing floodplain and upland desert habitat is replace by residential and commercial development.	• None	• Patchwork effect results from uneven distribution of bank armor types with gaps between.	• Development encroaches on channel increasing runoff. • Channel and floodplain reduced by development does not accommodate 100-year flood. • Unprotected development on banks and floodplain threatened by flood and lateral stream channel migration. • Public safety is placed at high risk.	$0

6. CONCLUSION

Reach 1 (Skunk Creek to Beardsley Road)

In Reach 1, existing development on the banks and floodplain of the New River has resulted in a defined floodway channel, the west bank of which has been armored by individual land owners and developers using soil cement and rock-filled wire gabions. There are gaps in the west bank armor where some landowners have not yet protected their land from erosion by the flooding of the New River. The east bank of the New River through Reach 1 is, for the most part, unprotected by bank armor.

The adjoining development and associated channelization of the New River through Reach 1 has resulted in significant degradation of potential habitat. The differing types of bank armor applied to portions of the west bank, with gaps where no armor has been applied have resulted in an unattractive visual patchwork. Soil cement bank armor is regarded by the public as "sterile" and is not preferred to the less expensive rock-filled gabion armor. Neither the public nor the Steering Committee has expressed a preference for more expensive alternatives of channel development which provide for landscape enhancement, a trail bench, or a low-flow channel with an expanded overbank area. Returning Reach 1 to a natural channel and floodplain regime is not acceptable because of the significant expense of acquiring and clearing sufficient adjoining developed land to accommodate a natural channel system. The No Action alternative is unacceptable because it does not protect unarmored channel sides or infrastructure in Reach 1 and is a public safety hazard.

The impact to Waters of the U.S. of the practicable alternatives is approximately equal. For this reason, the public and the Steering Committee has selected the least expensive alternative, Alternative 2, for the management of the New River channel and banks through Reach 1.

Reach 2 (Beardsley Road to Pinnacle Peak Road)

As in Reach 1, the existing and planned development on the banks and floodplain of the New River in Reach 2 are resulting in a defined floodway channel. In Reach 2, where the channel banks have been armored, the style of armor has been rock-filled gabions. The extent of the existing bank armoring in Reach 2 is less than in Reach 1.

The condition of the New River channel and the quality of the wildlife habitat through Reach 2 are approximately equivalent to those of Reach 1. In order to avoid the patchwork bank armor appearance that has been created by the haphazard armoring of the banks of Reach 1 while protecting the existing and planned developments on the land adjoining the New River, the public and the Steering Committee believe that the installation of rock-filled wire gabions offers the most cost-effective and least environmentally damaging practicable means of channel control to protect the public and existing infrastructure in Reach 2. The use of rock-filled gabions through Reaches 1 and 2 will result in a consistent pattern of armoring which will permit the reestablishment of volunteer vegetation on the slopes of the channel banks.

The alternatives requiring the use of soil cement armoring, Alternatives 1 and 4, were rejected for broad application by the public and the Steering Committee because of their expense, appearance, and their incompatibility with the reestablishment of vegetation on the channel side slopes. Alternative 4 will be applied only at bridge crossings to provide the public a safe means to avoid vehicular traffic when travelling on the future pathways adjacent to the New River channel.

Alternatives 3 and 5 were rejected by the public and the Steering Committee because they are more expensive and would require extensive repair and reconstruction within the New River channel following floods.

Returning Reach 2 to a natural channel and floodplain regime (Alternative 6) is not acceptable. Existing and planned developments (Hillcrest, Fletcher Heights, Community of Joy, etc.) occupy the floodplain adjoining the channel and banks of the New River in Reach 2. The expense of acquiring and clearing sufficient adjoining developed land to accommodate a natural channel system and the relocation of the current occupants is prohibitive. Existing channel crossings and infrastructure would not be adequately protected.

The No Action alternative is unacceptable because it does not protect unarmored channel sides in Reach 2 or infrastructure within and downstream of Reach 2.

Reach 3 (Pinnacle Peak Road to New River Dam)

Except for the area of the Terramar residential development on the east bank of the New River between Happy Valley Road and Jomax Road, Reach 3 of the middle New River is primarily adjoined by undeveloped land. Reach 3 offers the best opportunity for the Cities of Peoria and Glendale to plan development around the natural channel and floodplain rather than accommodating a channel where significant encroachment and disturbance has already taken place. Alternative 6, the establishment of an erosion buffer zone between land planned for development and the banks of the New River, provides the opportunity for the cities to exercise a lower-cost management policy which results in the least impact to the channel of the New River and the associated and adjoining wildlife habitat and preserves the habitat and river channel in a nearly natural condition as open space capable of transporting floodwater without damage to adjoining and downstream developments or infrastructure. This non-structural approach was strongly favored by the public and the Steering Committee for Reach 3.

In regards to cost and impact on the environment, with the exception of the No Action Alternative, the preferred alternative, is the least environmental disturbing available. Under the No Action Alternative, development defines the channel of the New River and replaces existing natural habitat. In addition, the No Action

Alternative fails to protect adjoining and downstream developments and infrastructure.

For the foregoing reasons, the public, the Steering Committee, and the Cities of Peoria and Glendale have selected the most cost effective and least environmentally disruptive management policy for the middle New River. The policy calls for the armoring of all of the currently unprotected banks of the New River through Reaches 1 and 2 with rock-filled gabions. The banks and channel of the New River through Reach 3 will be preserved, to the extent possible, in a natural state with the exception of minor modifications to the banks and channel in bends.

7. REFERENCES

1. Flood Control District of Maricopa County (FCDMC). 1999. *Final Report, Middle New River Watercourse Master Plan* prepared by Stantec Consulting, Inc., Phoenix, Arizona.

2. Flood Control District of Maricopa County (FCDMC). 1999. *Technical Data Notebook, Middle New River Watercourse Master Plan* prepared by Stantec Consulting, Inc., Phoenix, Arizona.

3. Flood Control District of Maricopa County (FCDMC). 1999. *Alternatives Formulation Notebook, Middle New River Watercourse Master Plan* prepared by Stantec Consulting, Inc., Phoenix, Arizona.

4. Giacobbe, J.A., and Larkin, R.A. 1998. *Middle New River Watercourse Master Plan: Cultural Resources Overview.* Prepared for the Flood Control District of Maricopa County, Arizona. Stantech Consulting, Inc. Phoenix, Arizona.

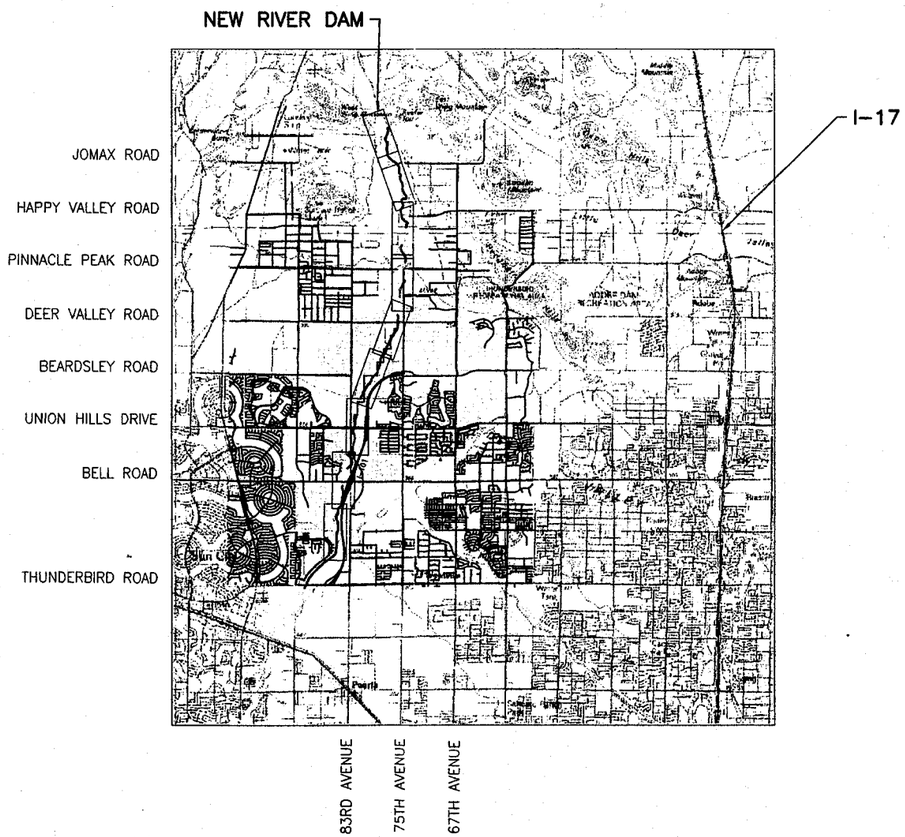
5. Johnson, R.A. 1999. *Overview of Biological Resources in the Middle New River Watercourse (Confluence with Skunk Creek to New River Dam).* Johnson and Associates, EEI, Inc. Tempe, Arizona.

APPENDIX A

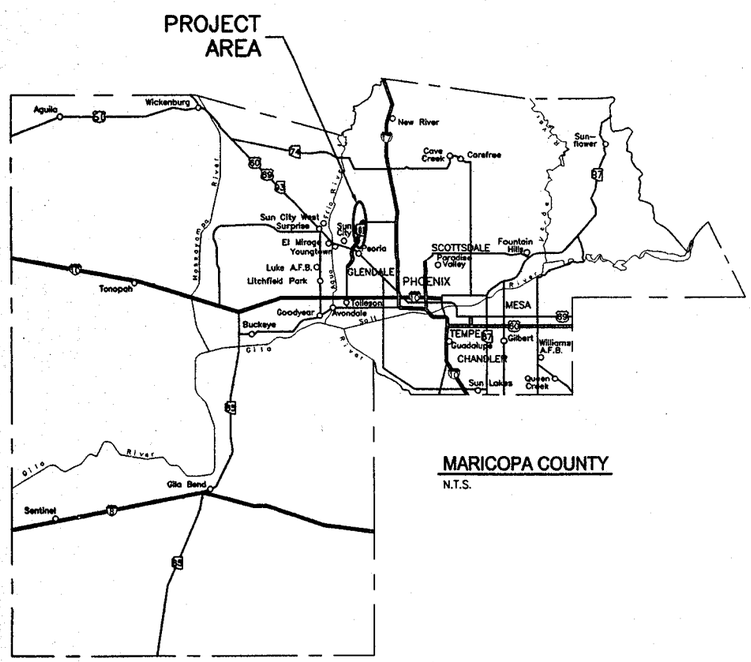
Preferred Alternative Conceptual Construction Plans for Middle New River Master Plan Reaches 1-3

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CONCEPTUAL PLANS FOR THE MIDDLE NEW RIVER WATERCOURSE MASTER PLAN IMPROVEMENTS



LOCATION PLAN - GLENDALE/PEORIA, AZ.
MIDDLE NEW RIVER AND SKUNK CREEK
N.T.S.



MARICOPA COUNTY
N.T.S.

THE MIDDLE NEW RIVER WATERCOURSE MASTER PLAN ACCOMODATES RECREATIONAL TRAILS.
FOR A DESCRIPTION AND LOCATION OF RECREATIONAL TRAILS OR MULTI-USE TRAILS, CONTACT THE PLANNING DEPARTMENTS FOR THE CITIES OF PEORIA AND GLENDALE

PRELIMINARY PLAN
NOT FOR CONSTRUCTION OR RECORDING
ARIZONA TECH. BOARD OF REGISTRATION R4-30-304

Stantec
Stantec Consulting Inc.
7776 POINTE PARKWAY W, STE 290
Phoenix AZ 85044 U.S.A.
Tel. 602.438.2200
Fax. 602.431.9562
www.stantec.com

MARICOPA COUNTY FLOOD CONTROL DISTRICT

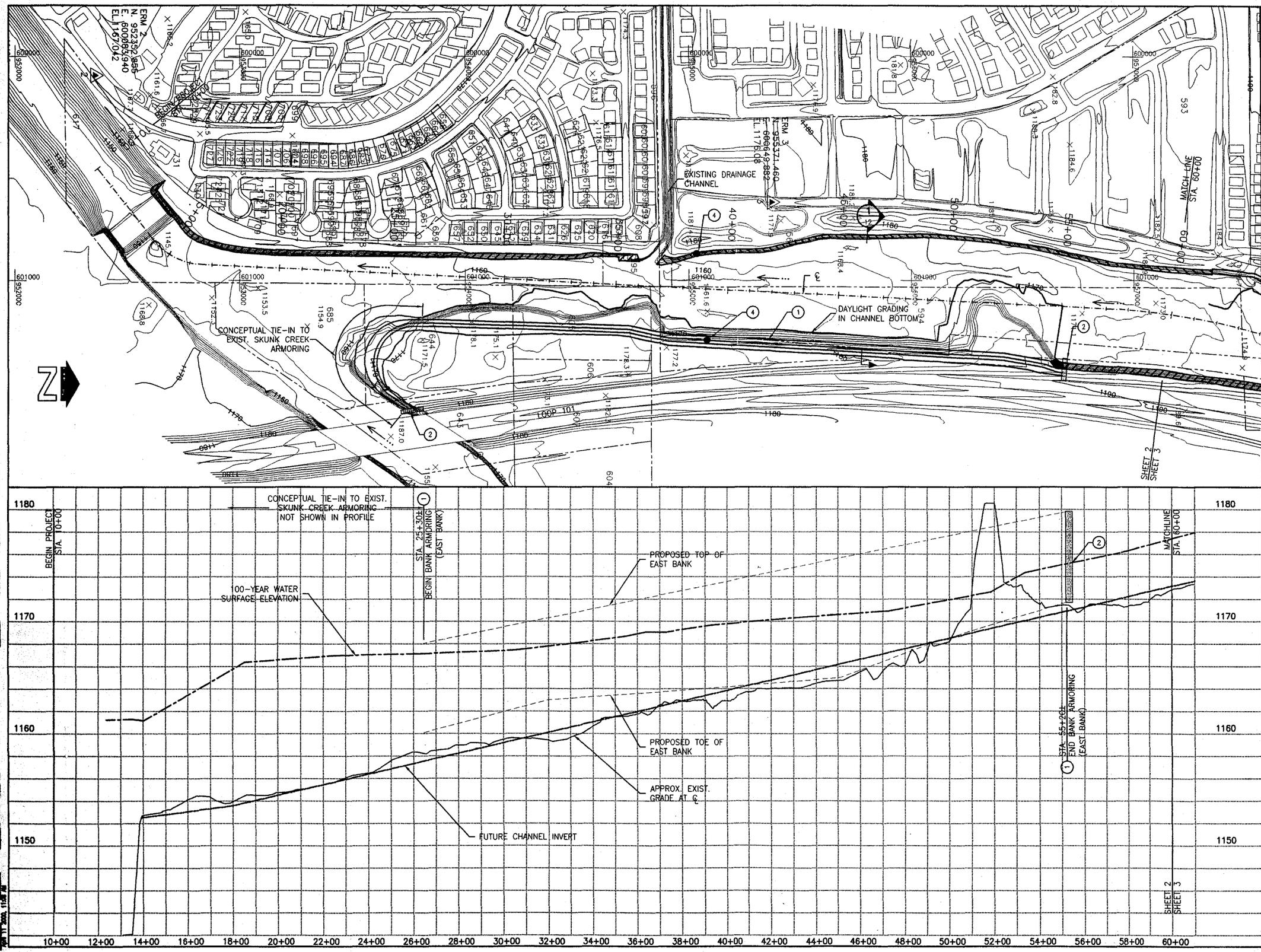
ISSUED FOR PUBLIC BIDDING BY:

N/A	N/A
PROJECT MANAGER	DATE

COUNTY BOARD OF SUPERVISORS

JIM BRUNER – CHAIRMAN

DISTRICT 1 FULTON BROCK
DISTRICT 2 DON STAPLEY
DISTRICT 3 ANDREW KUMASEK
DISTRICT 4 JANICE BREWER
DISTRICT 5 MARY ROSE WILCOX



CONSTRUCTION NOTES

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- PROPERTY LINE (LOCATION APPROXIMATE)
- EXISTING UTILITY POLE.
- FLOW DIRECTION

200' 0' 200' 400'

CONTOUR INTERVAL:2 FEET

NO.	REVISION	BY	DATE
3			
2	RED LINE CORRECTIONS	P.J.E.	04/10/00
1	RED LINE CORRECTIONS	P.J.E.	01/10/00

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

MIDDLE NEW RIVER WATERCOURSE MASTER PLAN
PROJECT NO. 28900058

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DRAWN	P.W./P.R.	05/21/99
CHECKED	S.S.S./P.J.E.	05/21/99

PRELIMINARY NOT FOR CONSTRUCTION

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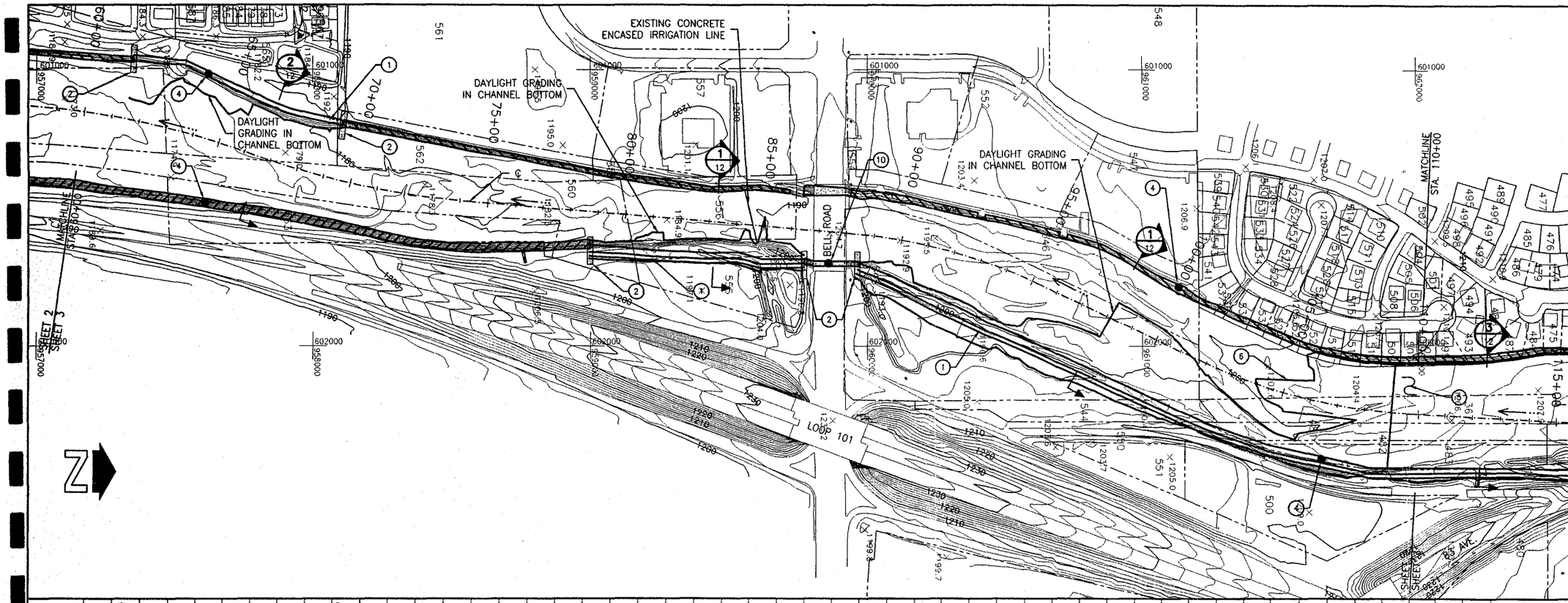
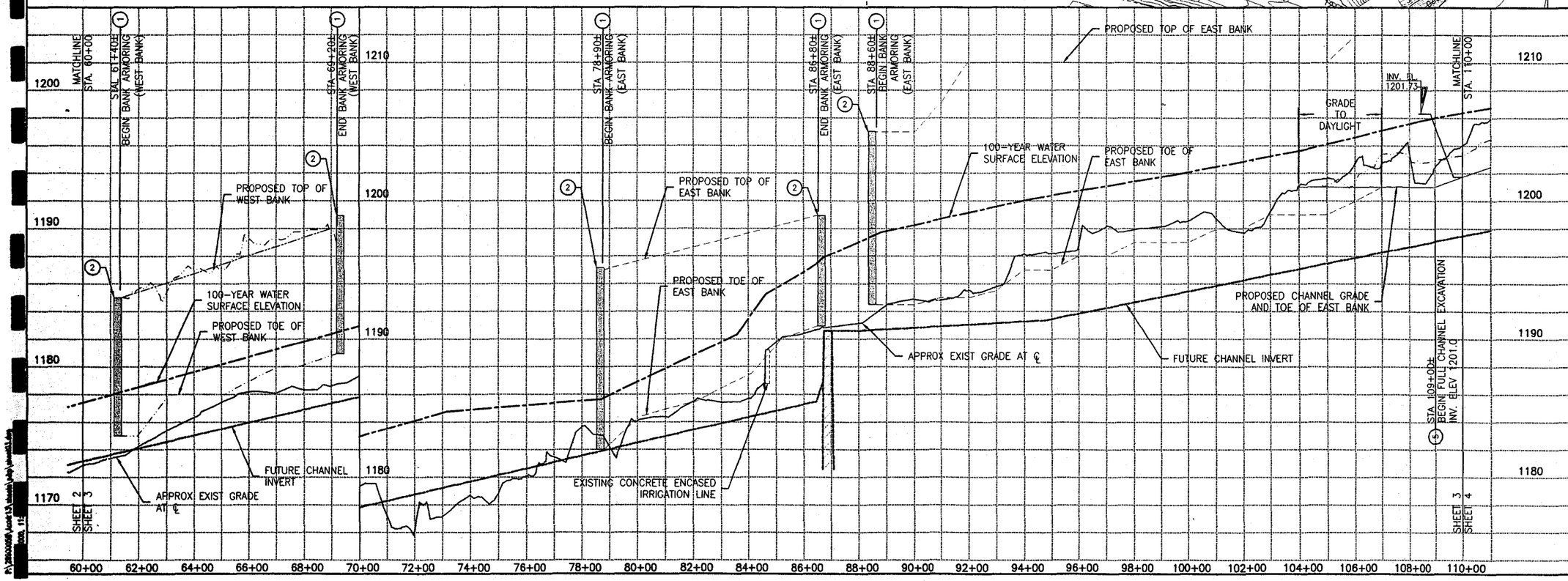
STA. 10+00.00 TO 60+00.00

SHEET 2 OF 23





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200' 0' 200' 400'

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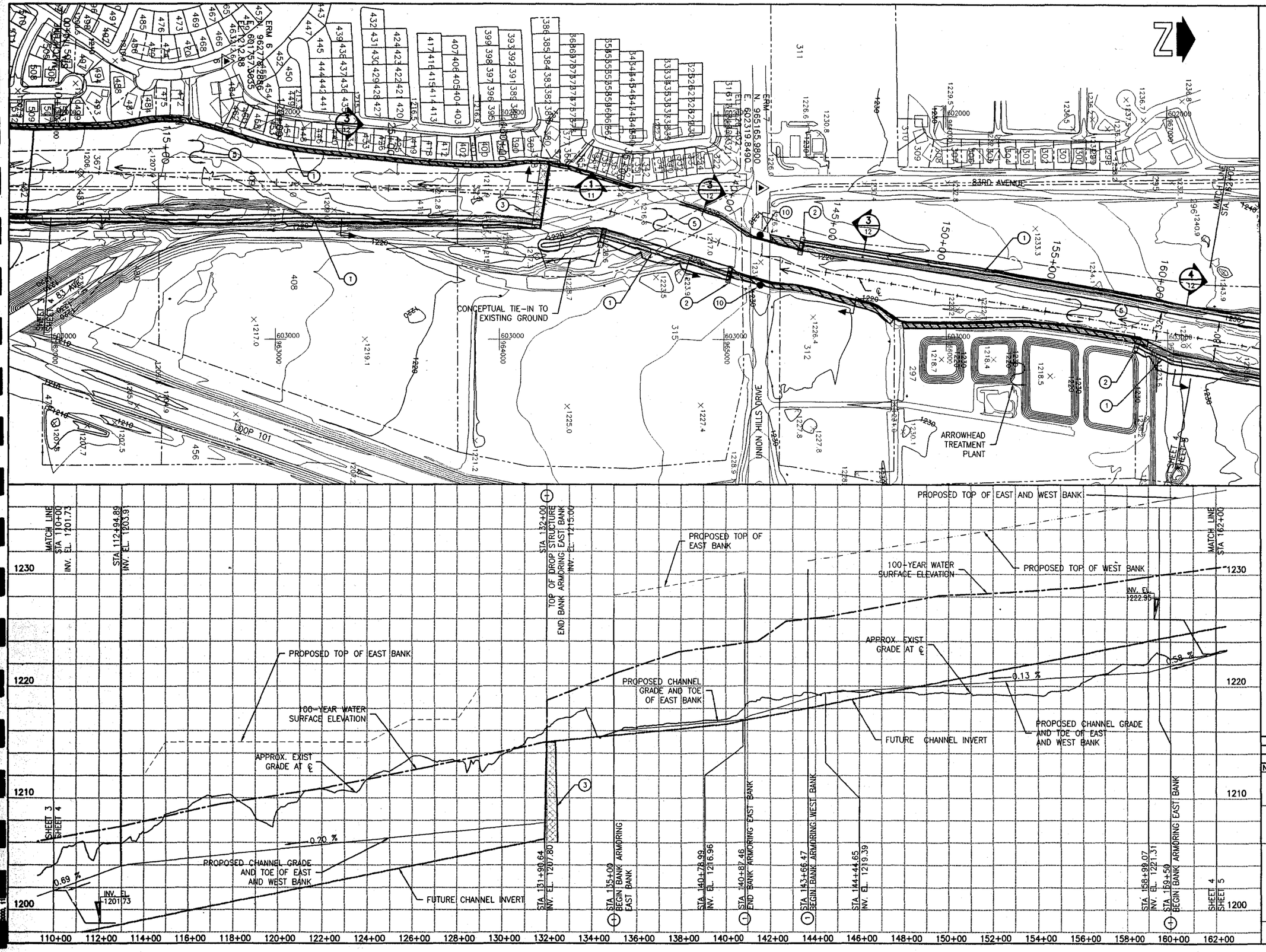
PLAN AND PROFILE
STA. 60+00 TO 110+00

SHEET OF 3 23



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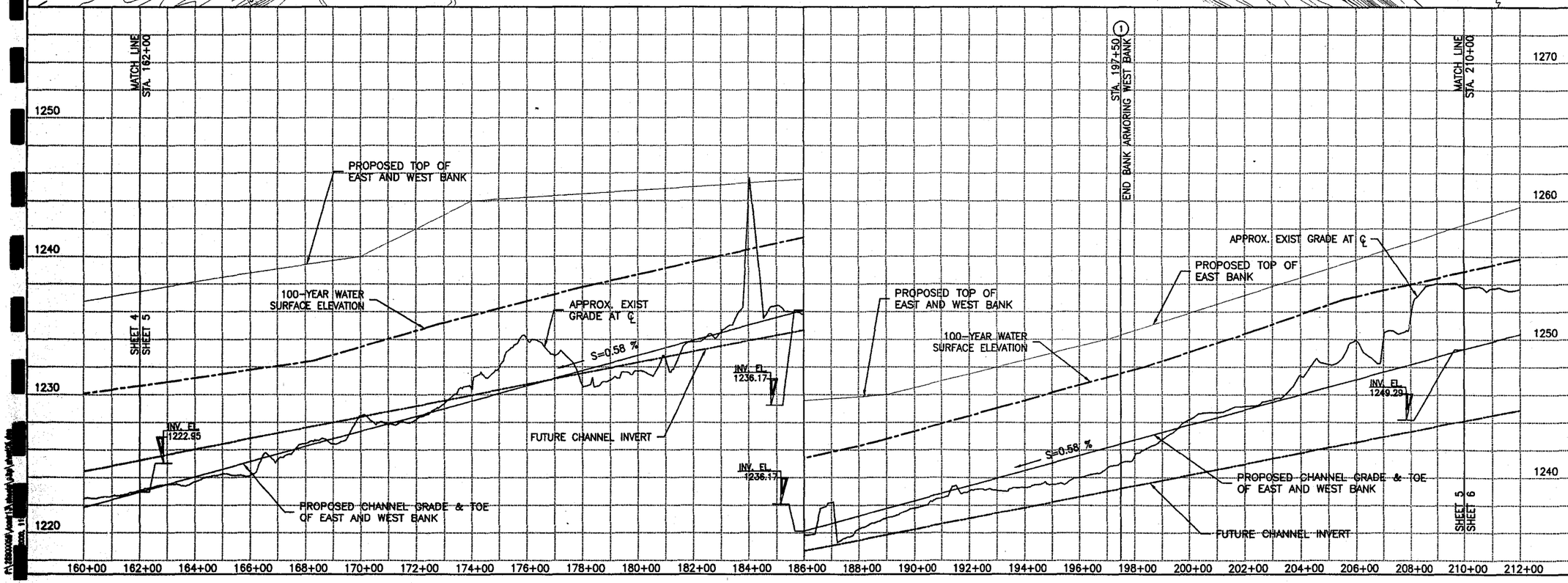

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PLAN AND PROFILE
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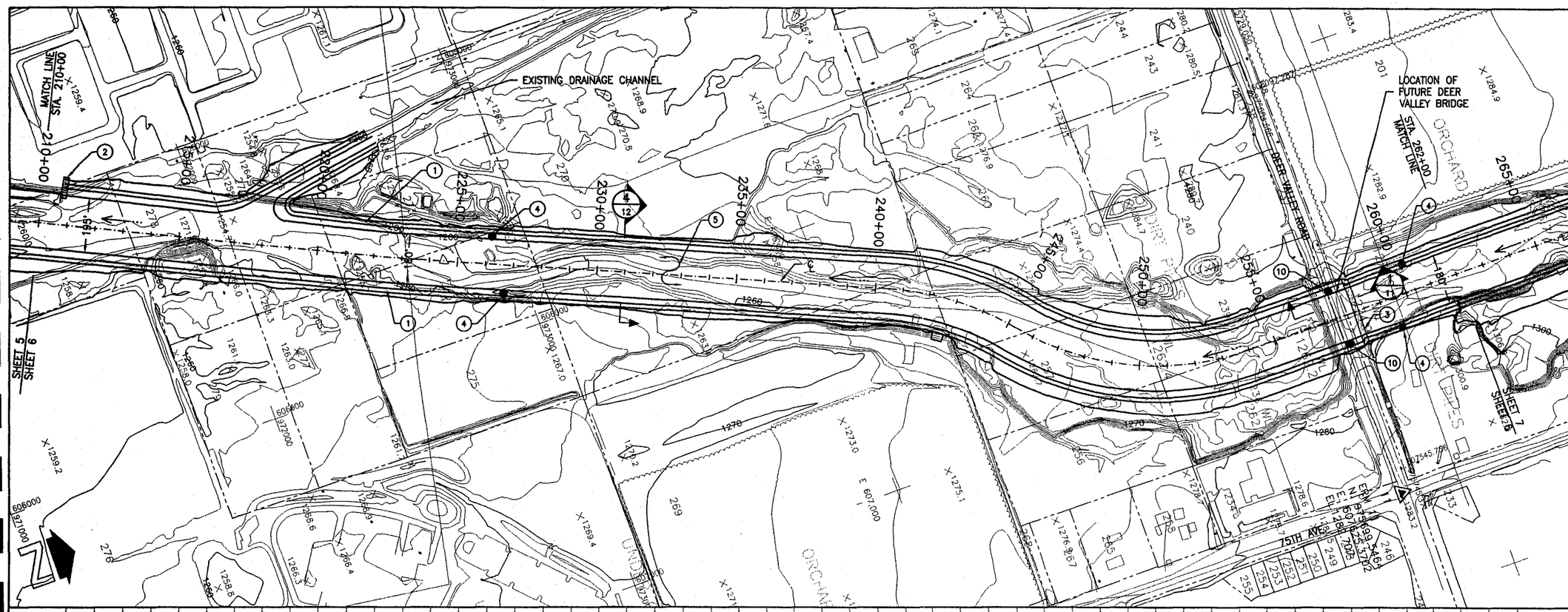
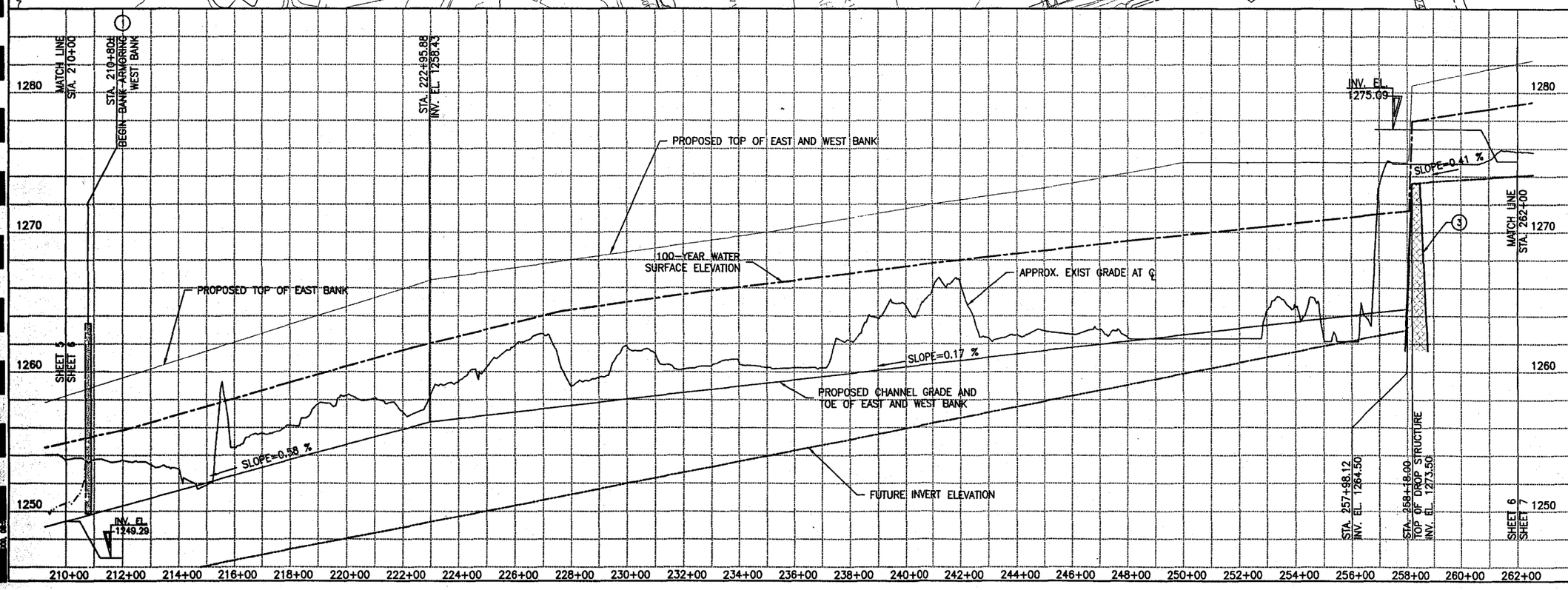
SHEET 5 OF 23





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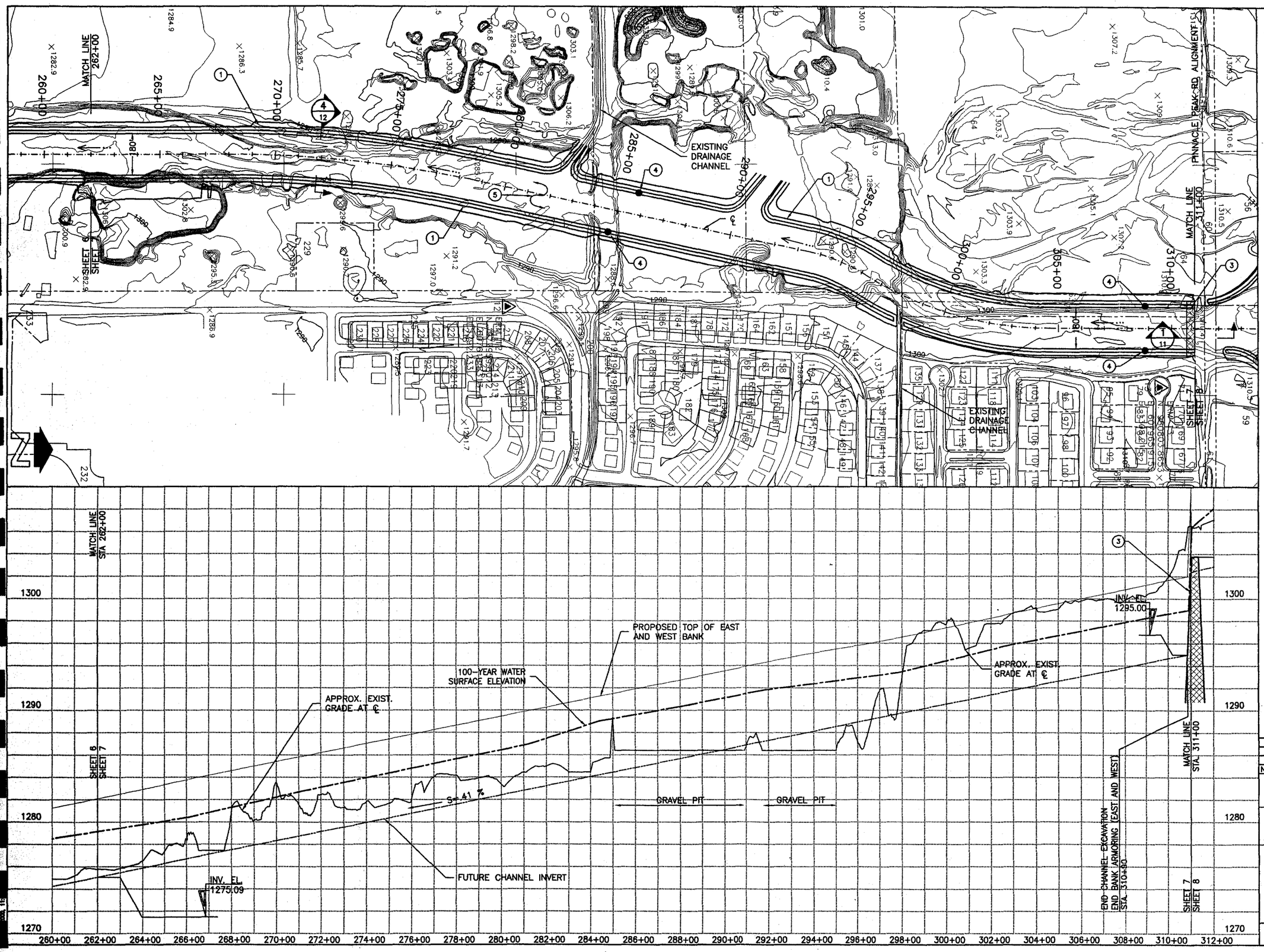
PRELIMINARY NOT FOR CONSTRUCTION

Stantec

PLAN AND PROFILE
STA. 210+00 TO 262+00

SHEET 6 OF 23



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PLAN AND PROFILE
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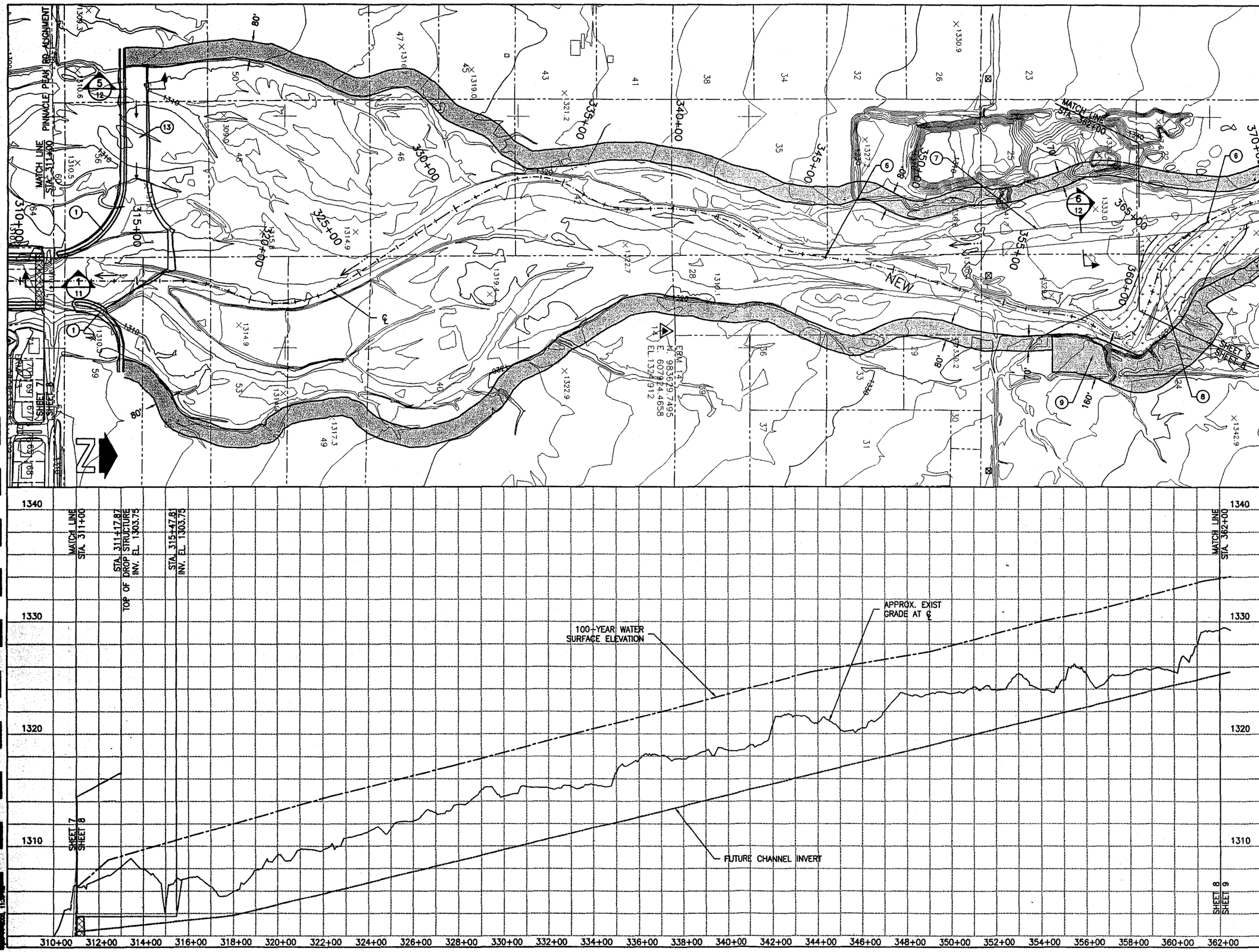
SHEET 7 OF 23



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- EXISTING UTILITY POLE.
- FLOW DIRECTION

200' 0' 200' 400'

CONTOUR INTERVAL:2 FEET

NO.	REVISION	BY	DATE
3			
2	RED LINE CORRECTIONS	P.J.E.	04/10/00
1	RED LINE CORRECTIONS	P.J.E.	01/10/00

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

MIDDLE NEW RIVER WATERCOURSE MASTER PLAN
PROJECT NO. 28900058

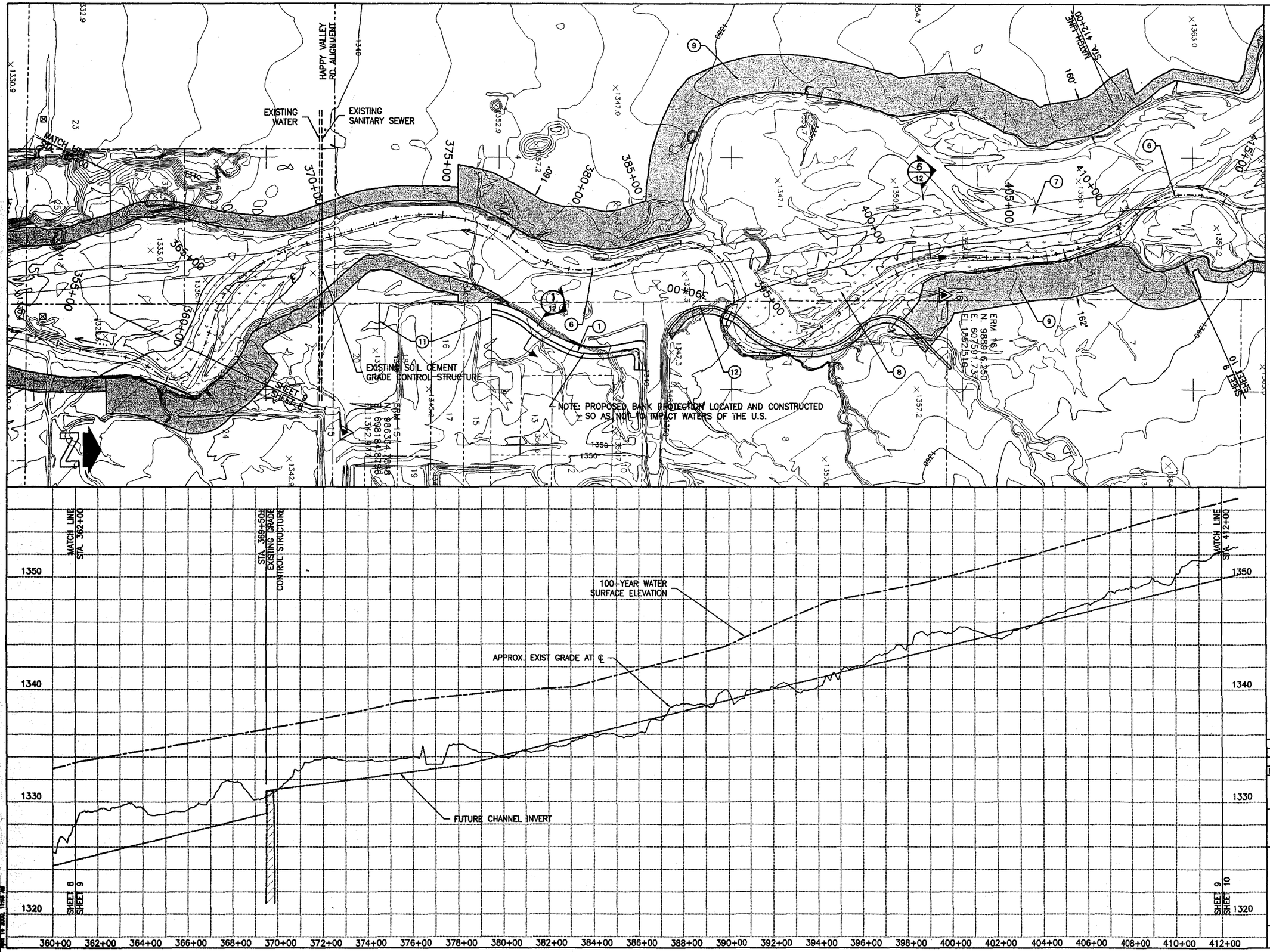
	BY	DATE
DESIGNED	P.J.E./C.A.S.	05/21/99
DRAWN	P.W./P.R.	05/21/99
CHECKED	S.S.S./P.J.E.	05/21/99

PRELIMINARY NOT FOR CONSTRUCTION

Stantec

PLAN AND PROFILE
STA. 311+00 TO 362+00

SHEET 8 OF 23



CONSTRUCTION NOTES

1. PROVIDE ROCK FILLED WIRE BASKETS TYPE BANK PROTECTION ON GRADED CHANNEL SLOPES.
2. TIE INTO EXISTING BANK PROTECTION. SIDE SLOPE TRANSITION MAY BE REQUIRED.
3. PROVIDE RCC STEPPED DROP STRUCTURE WITH RIP-RAP INLET/OUTLET PROTECTION.
4. PROVIDE CHANNEL ACCESS RAMP PER DETAIL (LOCATION APPROXIMATE) 2/13.
5. EXCAVATE CHANNEL BOTTOM.
6. MATCH EXISTING CHANNEL INVERT ELEVATION.
7. ALIGNMENT OF LOW FLOW CHANNEL TO MINIMIZE BANK EROSION.
8. RE-GRADE AND PROVIDE NATIVE VEGETATION. FINISH GRADING AND VEGETATION SHOULD APPEAR NATURAL.
9. EROSION SETBACK LIMITS. FOR CHANNEL SEGMENTS WITH OBVIOUS BENDS EROSION SETBACK IS EQUAL TO 2.5 TIMES THE VALUE CALCULATED FOR RELATIVELY STRAIGHT CHANNEL REACHES.
10. PROVIDE MULTI-USE TRAIL CROSSING AT BRIDGES PER DETAIL 1/13.
11. PROPOSED FLOOD WALL OR CONCRETE WALL (BY OTHERS).
12. PROPOSED GABION EMBANKMENT (BY OTHERS).
13. PROVIDE COLLECTOR CHANNEL.

LEGEND

- EROSION SETBACK
- EXISTING SOIL CEMENT BANK ARMORING.
- EXISTING ROCK FILLED WIRE TIED MATTRESS TYPE ARMORING.
- EXISTING CONCRETE ARMORING.
- TIE-IN TO EXISTING SLOPE CONDITIONS SEE 2.
- PROPOSED RCC STEPPED DROP STRUCTURE. SEE 3.
- EXISTING DUMPED RIP-RAP.
- AREA OF REGRADING AND REVEGETATION.
- PROPERTY LINE (LOCATION APPROXIMATE)
- EXISTING UTILITY POLE.
- FLOW DIRECTION

200' 0' 200' 400'

CONTOUR INTERVAL:2 FEET

NO.	REVISION	BY	DATE
3	RED LINE CORRECTIONS	P.J.E.	05/22/00
2	RED LINE CORRECTIONS	P.J.E.	04/10/00
1	RED LINE CORRECTIONS	P.J.E.	01/10/00

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

MIDDLE NEW RIVER
WATERCOURSE MASTER PLAN
PROJECT NO. 28900058

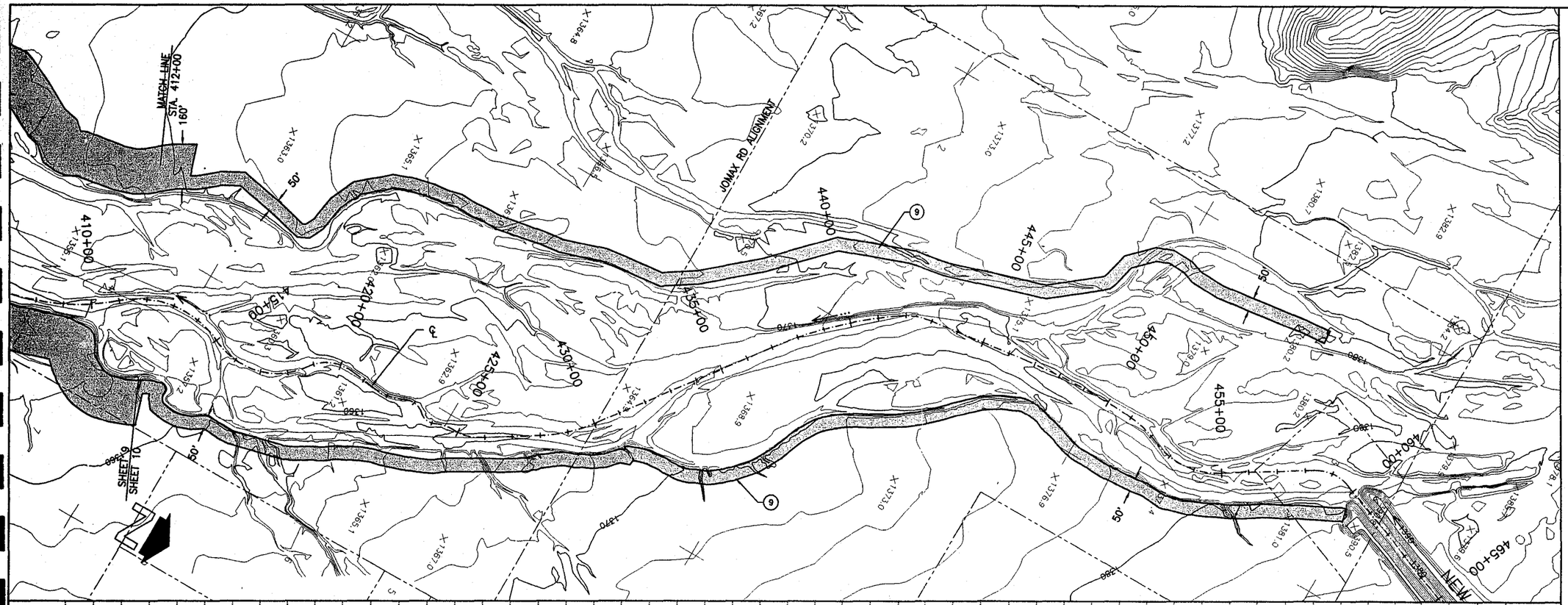
PRELIMINARY NOT FOR CONSTRUCTION

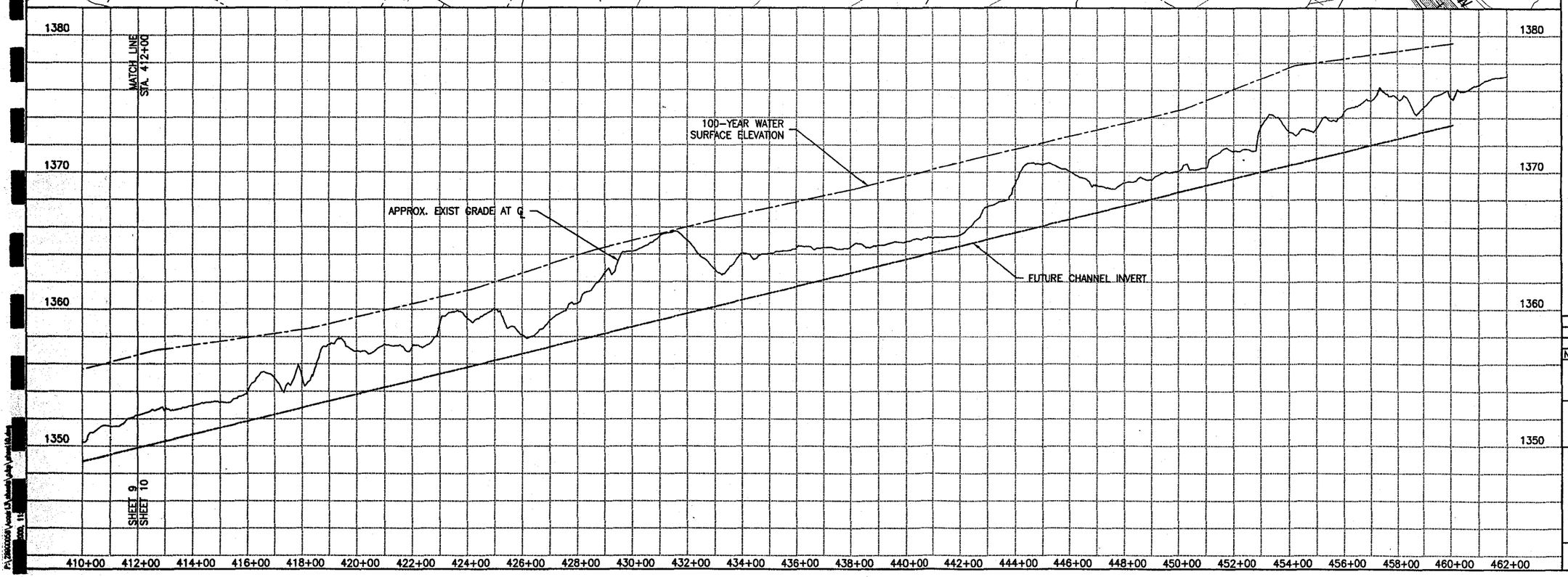
	BY	DATE
DESIGNED	P.J.E./C.A.S.	05/21/99
DRAWN	P.W./P.R.	05/21/99
CHECKED	S.S.S./P.J.E.	05/21/99

Stantec

PLAN AND PROFILE
STA. 362+00 TO 412+00

SHEET 9 OF 23





CONSTRUCTION NOTES

1. PROVIDE ROCK FILLED WIRE BASKETS TYPE BANK PROTECTION ON GRADED CHANNEL SLOPES.
2. TIE INTO EXISTING BANK PROTECTION. SIDE SLOPE TRANSITION MAY BE REQUIRED.
3. PROVIDE RCC STEPPED DROP STRUCTURE WITH RIP-RAP INLET/OUTLET PROTECTION.
4. PROVIDE CHANNEL ACCESS RAMP PER DETAIL (LOCATION APPROXIMATE) 2/13.
5. EXCAVATE CHANNEL BOTTOM.
6. MATCH EXISTING CHANNEL INVERT ELEVATION.
7. ALIGNMENT OF LOW FLOW CHANNEL TO MINIMIZE BANK EROSION.
8. RE-GRADE AND PROVIDE NATIVE VEGETATION. FINISH GRADING AND VEGETATION SHOULD APPEAR NATURAL.
9. EROSION SETBACK LIMITS. FOR CHANNEL SEGMENTS WITH OBVIOUS BENDS EROSION SETBACK IS EQUAL TO 2.5 TIMES THE VALUE CALCULATED FOR RELATIVELY STRAIGHT CHANNEL REACHES.
10. PROVIDE MULTI-USE TRAIL CROSSING AT BRIDGES PER DETAIL 1/13.
11. PROPOSED FLOOD WALL OR CONCRETE WALL (BY OTHERS).
12. PROPOSED GABION EMBANKMENT (BY OTHERS).
13. PROVIDE COLLECTOR CHANNEL.

LEGEND

- EROSION SETBACK
- EXISTING SOIL CEMENT BANK ARMORING.
- EXISTING ROCK FILLED WIRE TIED MATTRESS TYPE ARMORING.
- EXISTING CONCRETE ARMORING.
- TIE-IN TO EXISTING SLOPE CONDITIONS SEE (2).
- PROPOSED RCC STEPPED DROP STRUCTURE. SEE (3).
- EXISTING DUMPED RIP-RAP.
- AREA OF REGRADING AND REVEGETATION.
- PROPERTY LINE (LOCATION APPROXIMATE)
- EXISTING UTILITY POLE.
- FLOW DIRECTION

200' 0' 200' 400'

CONTOUR INTERVAL:2 FEET

NO.	REVISION	BY	DATE
3			
2	RED LINE CORRECTIONS	P.J.E.	04/10/00
1	RED LINE CORRECTIONS	P.J.E.	01/10/00

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

MIDDLE NEW RIVER
WATERCOURSE MASTER PLAN
PROJECT NO. 28900058

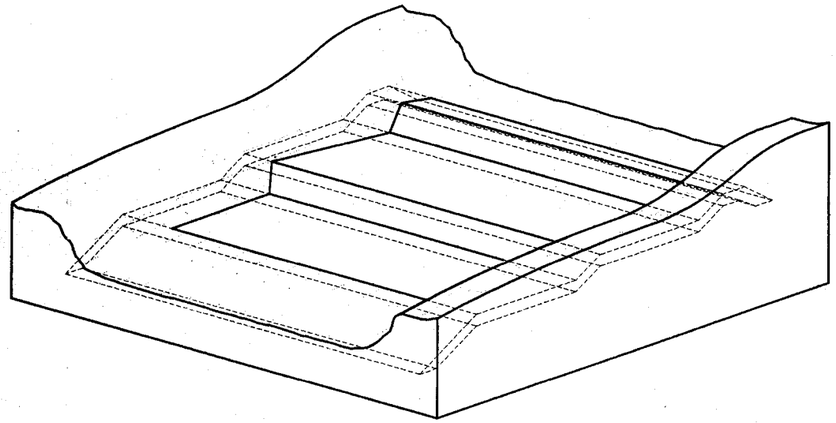
	BY	DATE
DESIGNED	P.J.E./C.A.S.	05/21/99
DRAWN	P.W./P.R.	05/21/99
CHECKED	S.S.S./P.J.E.	05/21/99

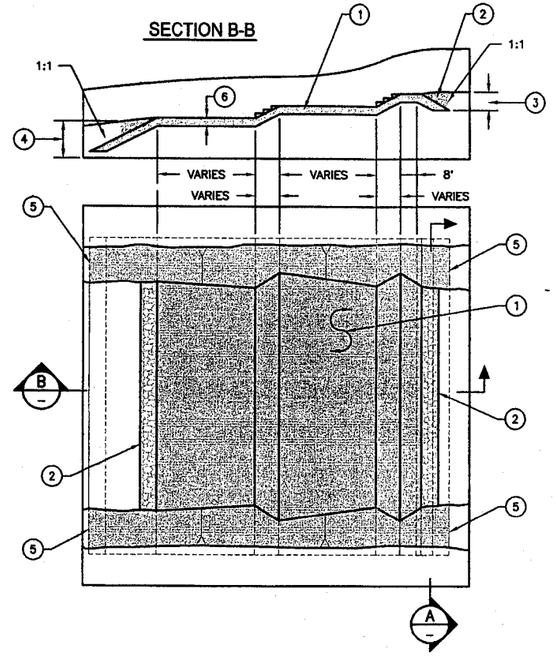
PRELIMINARY NOT FOR CONSTRUCTION

Stantec

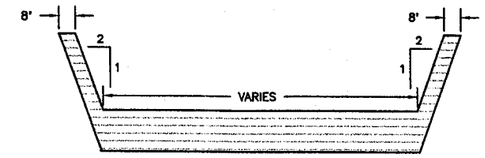
PLAN AND PROFILE
STA. 412+00 TO 462+00

SHEET OF 10 23

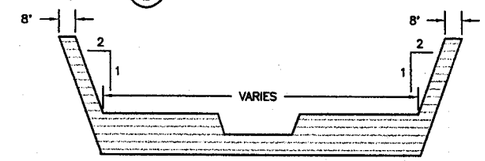




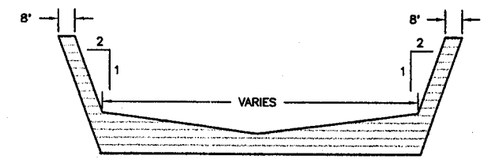
DOUBLE STAGE DROP STRUCTURE (ALTERNATE)
N.T.S.



A LEVEL BOTTOM OPTION

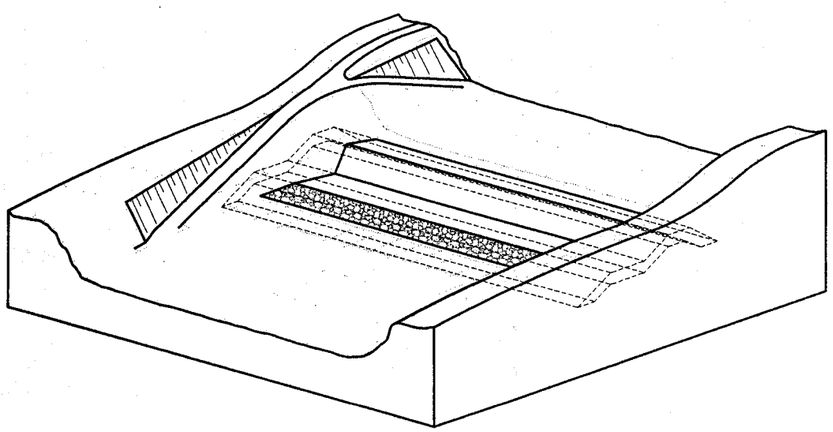


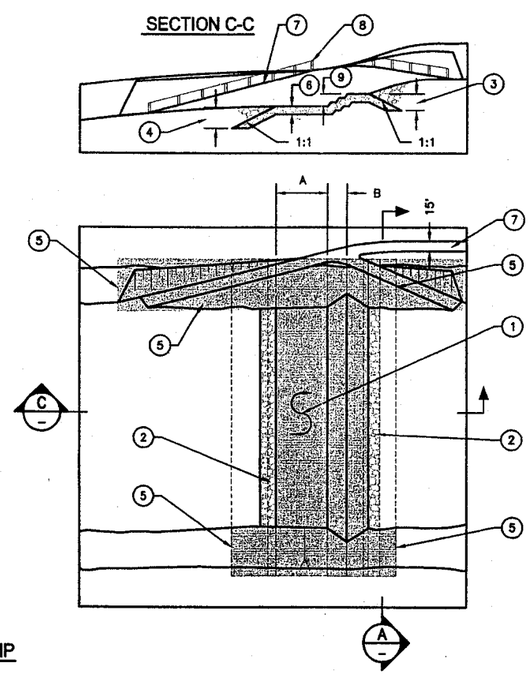
A LOW FLOW CHANNEL NOTCH OPTION



A "V" SHAPED CHANNEL OPTION

ROLLER COMPACTED CONCRETE DROP STRUCTURE DIMENSIONS SINGLE STAGE DROP STRUCTURE						
STATION 1	DIMENSION 3 (ft) 2	DIMENSION 4 (ft) 3	DIMENSION 6 (ft) 4	DIMENSION 9 (ft) 5	DIMENSION A (ft) 6	DIMENSION B (ft) 7
132+00	10	11	5	7.5	44	16
258+18	10.5	12	5	12	63	24
311+10	10	10	5	7.5	55	16





1 SINGLE STAGE DROP STRUCTURE W/ BANK RAMP
N.T.S.

DOUBLE STAGE DROP STRUCTURE

1 ROLLER COMPACTED CONCRETE (RCC) STEPPED DROP STRUCTURE
2 DUMPED RIP-RAP
3 UPSTREAM DROP STRUCTURE TOE DOWN
4 DOWNSTREAM DROP STRUCTURE TOE DOWN
5 TIE RCC ARMORING INTO ROCK FILLED WIRE BASKETS
6 DROP STRUCTURE FLOOR THICKNESS

SINGLE STAGE DROP STRUCTURE

1 ROLLER COMPACTED CONCRETE STEPPED DROP STRUCTURE
2 DUMPED RIP-RAP
3 UPSTREAM DROP STRUCTURE TOE DOWN
4 DOWNSTREAM DROP STRUCTURE TOE DOWN
5 TIE RCC ARMORING INTO ROCK FILLED WIRE BASKETS
6 DROP STRUCTURE FLOOR THICKNESS
7 ACCESS RAMP. RAMP SLOPE NOT TO EXCEED 10%
8 PROVIDE SAFETY RAIL

NO.	REVISION	BY	DATE
3			
2	RED LINE CORRECTIONS	P.J.E.	04/10/00
1	RED LINE CORRECTIONS	P.J.E.	01/10/00

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

MIDDLE NEW RIVER WATERCOURSE MASTER PLAN
PROJECT NO. 28900058

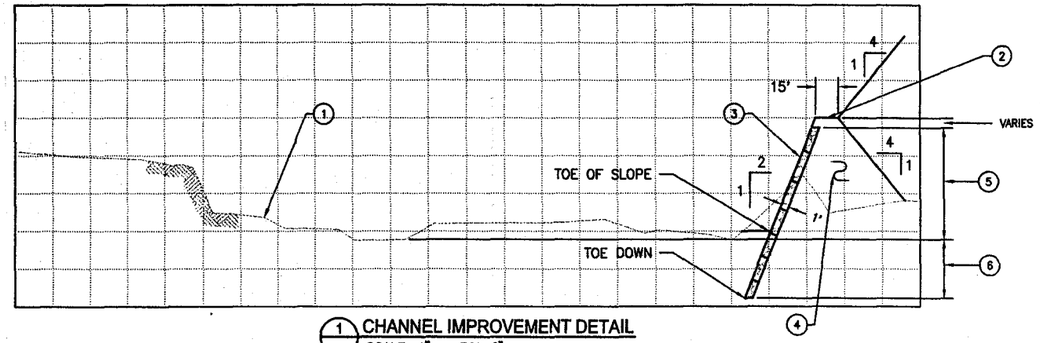
PRELIMINARY NOT FOR CONSTRUCTION

	BY	DATE
DESIGNED	P.J.E.	05/21/99
DRAWN	C.A.S.	05/21/99
CHECKED	S.S.S./P.J.E.	05/21/99

Stantec

DETAIL SHEET
DROP STRUCTURE ALTERNATIVES

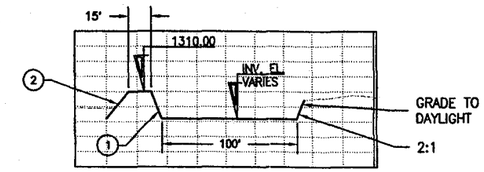
SHEET 11 OF 23



1 CHANNEL IMPROVEMENT DETAIL
SCALE: 1" = 50'-0"

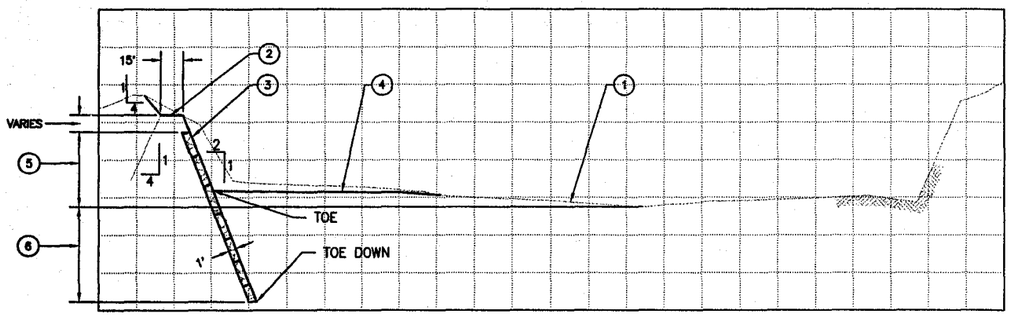
KEYNOTES:

1 EXISTING GROUND
2 15 FOOT WIDE CORRIDOR TO ACCOMMODATE RECREATIONAL TRAIL SYSTEM AND/OR MAINTENANCE ACCESS
3 1 FOOT THICK ROCK FILLED WIRE BASKET BANK ARMORING
4 EARTHEN FILL MATERIAL
5 ARMORED CHANNEL HEIGHT, SEE TABLE D-1
6 TOE-DOWN DEPTH, SEE TABLE D-1



5 COLLECTOR CHANNEL SECTION

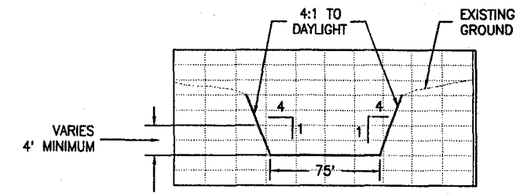
1 2:1 SIDE SLOPES
2 4:1 SIDE SLOPE TO EXISTING GROUND



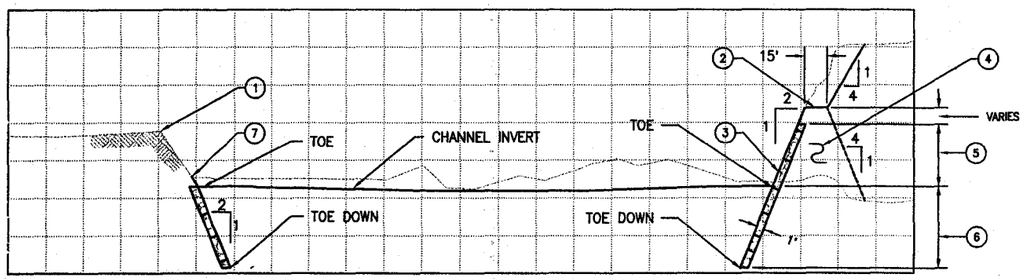
2 CHANNEL IMPROVEMENT DETAIL
SCALE: 1" = 50'-0"

KEYNOTES:

1 EXISTING GROUND
2 15 FOOT WIDE CORRIDOR TO ACCOMMODATE RECREATIONAL TRAIL SYSTEM AND/OR MAINTENANCE ACCESS
3 1 FOOT THICK ROCK FILLED WIRE BASKET BANK ARMORING
4 GRADE FROM TOE OF SLOPE TO CHANNEL DAYLIGHT
5 ARMORED CHANNEL HEIGHT, SEE TABLE D-1
6 TOE-DOWN DEPTH, SEE TABLE D-1



6 LOW FLOW CHANNEL SECTION



3 CHANNEL IMPROVEMENT DETAIL
SCALE: 1" = 50'-0"

KEYNOTES:

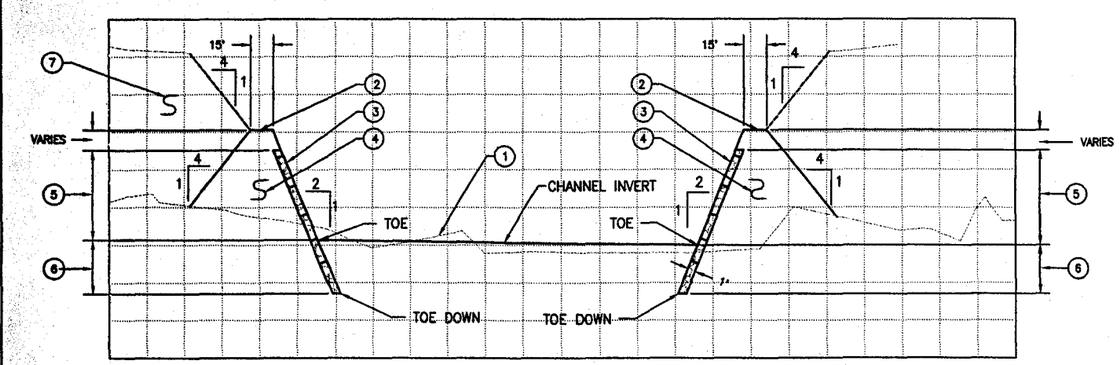
1 EXISTING GROUND
2 15 FOOT WIDE CORRIDOR TO ACCOMMODATE RECREATIONAL TRAIL SYSTEM AND/OR MAINTENANCE ACCESS
3 1 FOOT THICK ROCK FILLED WIRE BASKET BANK ARMORING
4 EARTHEN FILL MATERIAL
5 ARMORED CHANNEL HEIGHT
6 TOE-DOWN DEPTH
7 TIE IN TO EXISTING BANK PROTECTION, TOE DOWN MAY NEED TO BE EXTENDED, POT HOLE FOR FINAL DESIGN

ARMORED CHANNEL HEIGHT AND TOW DOWN DEPTH

BEGINNING STA	ENDING STA	AVERAGE ARMORED CHANNEL HEIGHT (ft)	AVERAGE TOE DOWN DEPTH (z:1)	AVERAGE CHANNEL HEIGHT +TOE DOWN DEPTH (ft)
1	2	3	4	5
26+30	43+00	10.5	10	20.50
43+00	55+00	8	10	18.00
61+50	69+50	11	10	21.00
78+50	86+50	7	10	17.00
88+50	108+50	8	13	21.00
108+50	126+60	7.5	13	20.50
126+60	132+00	7.5	10.5	18.00
135+00	140+90	9.5	10.5	20.00
143+80	163+00	11	10.5	21.50
163+00	182+70	7.5	10.5	18.00
182+70	222+50	7	14	21.00
222+50	248+50	9.5	14	23.50
248+50	258+00	9.5	10.5	20.00
258+00	311+00	8	12	20.00
379+00	384+50	7	8.5	15.50

COLUMN 3 – AS MEASURED FROM MINIMUM CHANNEL INVERT ELEVATION TO FREEBOARD ELEVATION.

COLUMN 4 – AS MEASURED FROM CHANNEL INVERT.



4 CHANNEL IMPROVEMENT DETAIL
SCALE: 1" = 50'-0"

KEYNOTES:

1 EXISTING GROUND
2 15 FOOT WIDE CORRIDOR TO ACCOMMODATE RECREATIONAL TRAIL SYSTEM AND/OR MAINTENANCE ACCESS
3 1 FOOT THICK ROCK FILLED WIRE BASKET BANK ARMORING
4 EARTHEN FILL MATERIAL
5 ARMORED CHANNEL HEIGHT
6 TOE-DOWN DEPTH

NO.	REVISION	BY	DATE
3	ADDED STATION 379+00 TO 384+50	P.J.E.	05/22/00
2	RED LINE CORRECTIONS	P.J.E.	04/10/00
1	RED LINE CORRECTIONS	P.J.E.	01/10/00

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

MIDDLE NEW RIVER
WATERCOURSE MASTER PLAN
PROJECT NO. 28900058

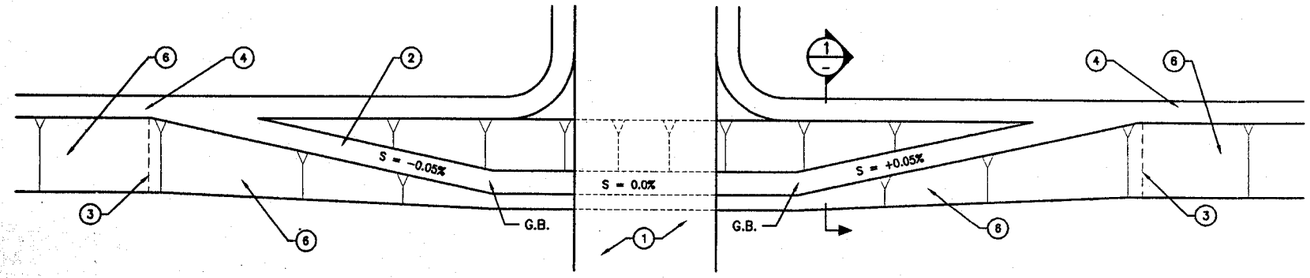
	BY	DATE
DESIGNED	P.J.E./C.A.S.	05/05/99
DRAWN	P.W./P.R.	05/05/99
CHECKED	S.S.S./P.J.E.	05/05/99

PRELIMINARY
NOT FOR
CONSTRUCTION

Stantec

PLAN AND PROFILE
TYPICAL ARMORING DETAILS

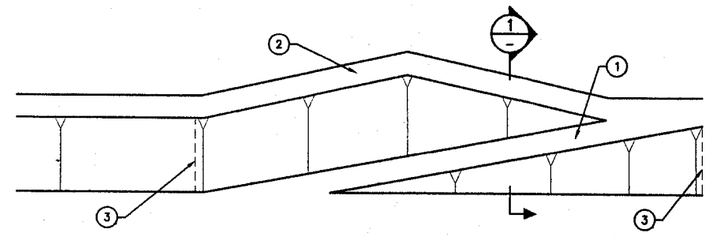
SHEET 12 OF 23



1. BRIDGE DECK
2. TRAIL/ACCESS RAMP
3. TIE SOIL CEMENT ARMORING TO ROCK FILLED WIRE BASKETS
4. AREA TO ACCOMMODATE MULTI-USE RECREATIONAL TRAIL
5. SOIL CEMENT ARMORING
6. ROCK FILLED WIRE BASKETS

1/- MULTI-USE TRAIL CROSSING DETAIL AT BRIDGES

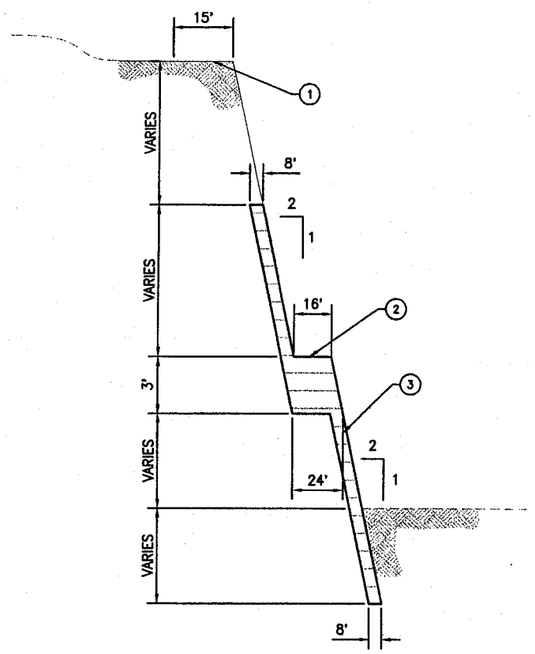
SCALE: 1" = 50'



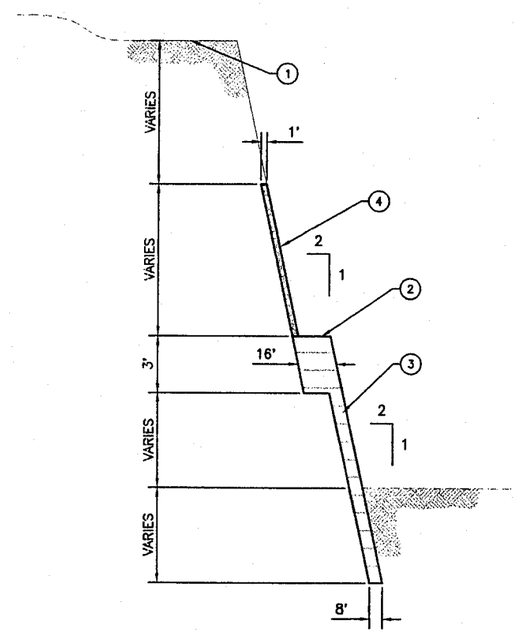
1. TRAIL/ACCESS RAMP. MAXIMUM RAMP GRADE =10%
2. AREA TO ACCOMMODATE MULTI-USE USE RECREATIONAL TRAIL
3. TIE SOIL CEMENT ARMORING TO ROCK FILLED WIRE BASKETS

2/- ACCESS RAMP DETAIL

SCALE: 1" = 50'



SOIL CEMENT OPTION



SOIL CEMENT AND ROCK FILLED WIRE BASKETS OPTION

1/- MULTI-USE TRAIL CROSSING OR RAMP DETAILS

1. AREA TO ACCOMMODATE MULTI-USE RECREATIONAL TRAIL
2. TRAIL/ACCESS RAMP
3. SOIL CEMENT ARMORING
4. ROCK FILLED WIRE BASKETS

NO.	REVISION	BY	DATE
3			
2	RED LINE CORRECTIONS	P.J.E.	04/10/00
1	RED LINE CORRECTIONS	P.J.E.	01/10/00

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

MIDDLE NEW RIVER
WATERCOURSE MASTER PLAN
PROJECT NO. 28900058

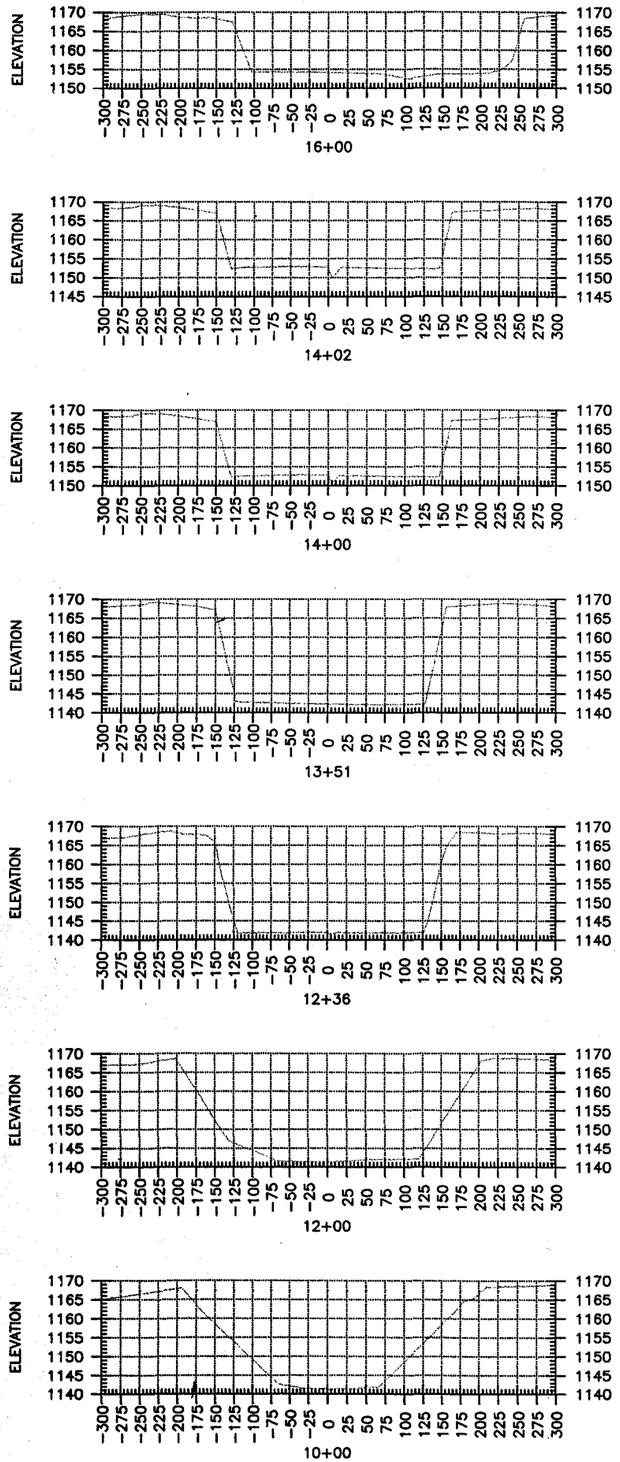
PRELIMINARY NOT FOR CONSTRUCTION

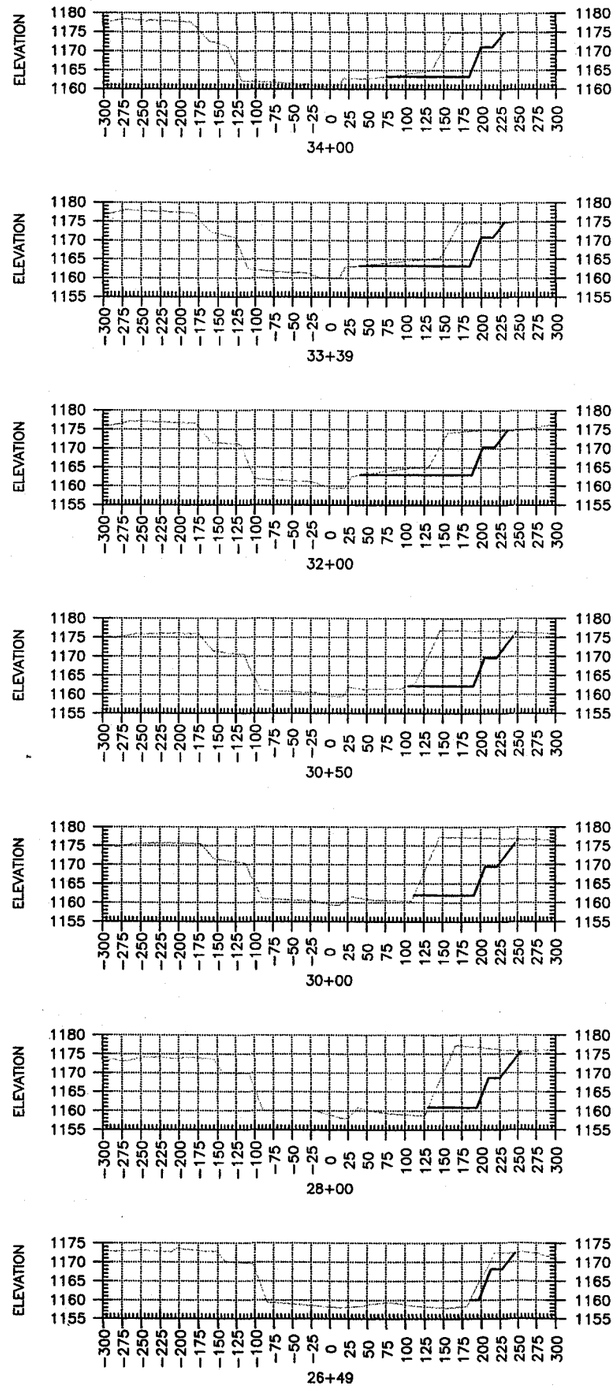
	BY	DATE
DESIGNED	P.J.E./C.A.S.	05/24/99
DRAWN	P.J.R.	05/24/99
CHECKED	S.S.S./P.J.E.	05/24/99

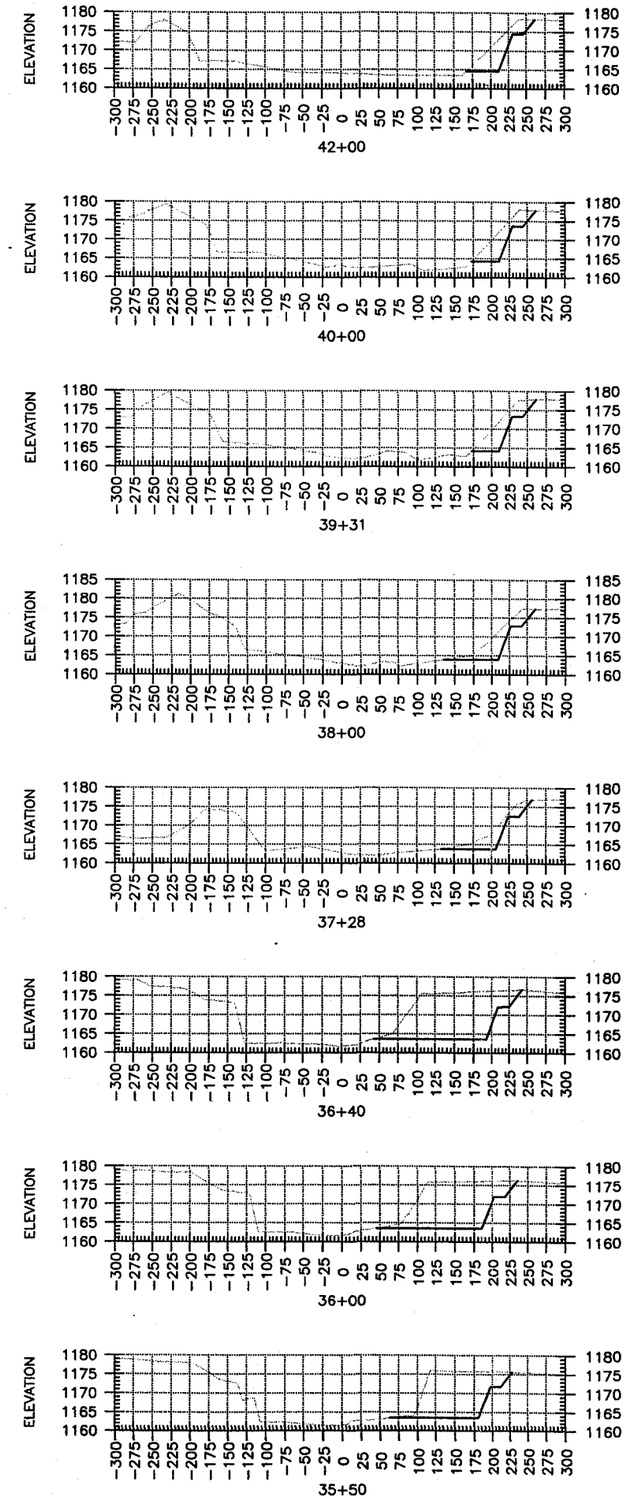
Stantec

DETAIL SHEET
MULTI-USE TRAIL CROSSING

SHEET 13 OF 23







NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

MIDDLE NEW RIVER
WATERCOURSE MASTER PLAN
PROJECT NO. 28900058

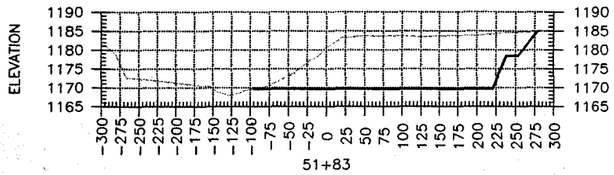
PRELIMINARY
NOT FOR
CONSTRUCTION

	BY	DATE
DESIGNED	C.A.S.	05/18/99
DRAWN	C.A.S.	05/18/99
CHECKED	S.S.S./P.J.E.	05/18/99

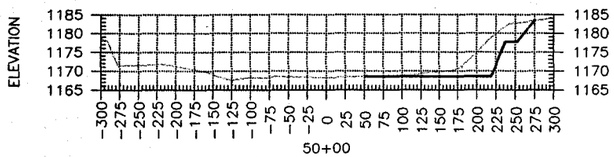
Stantec

CROSS SECTIONS
STA. 10+00 TO 42+00

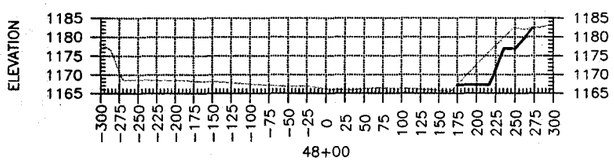
SHEET 14 OF 23



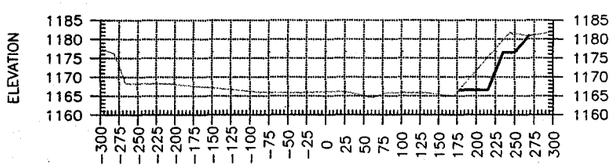
51+83



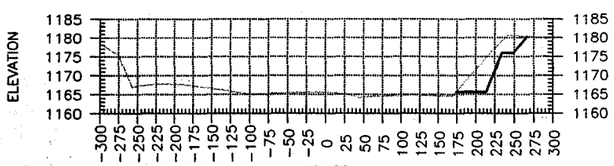
50+00



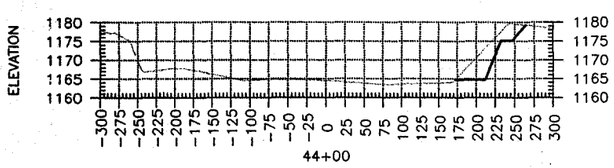
48+00



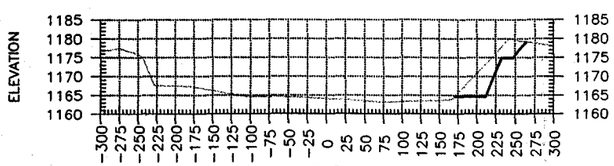
47+25



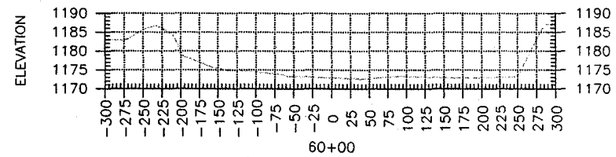
46+00



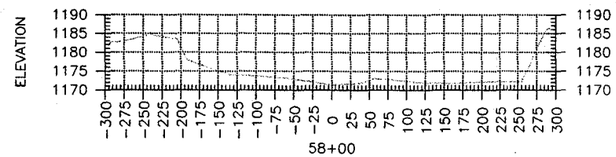
44+00



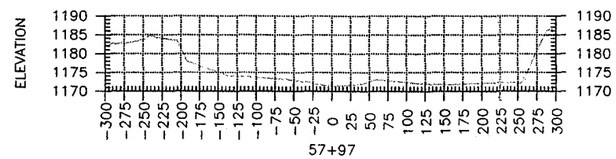
43+34



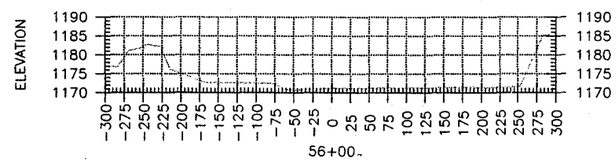
60+00



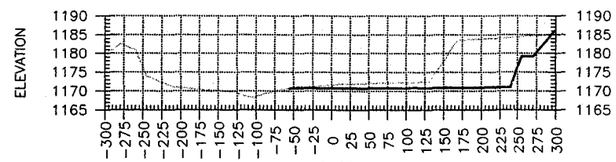
58+00



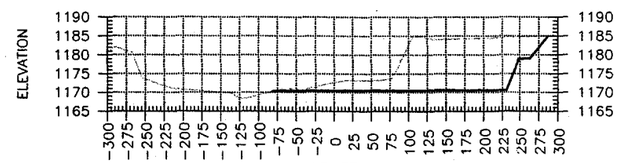
57+97



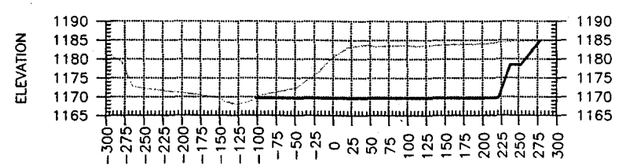
56+00



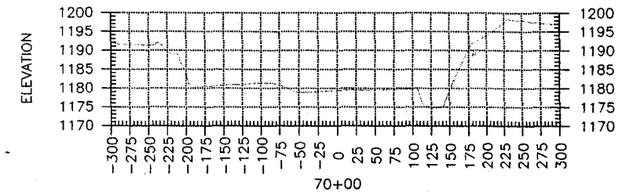
54+00



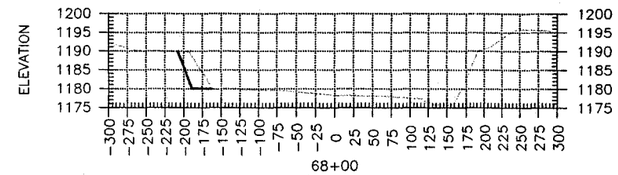
53+37



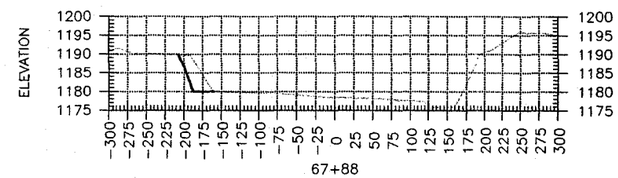
52+00



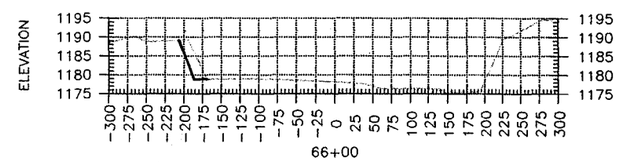
70+00



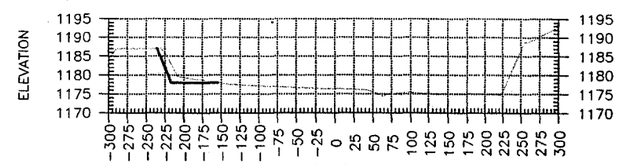
68+00



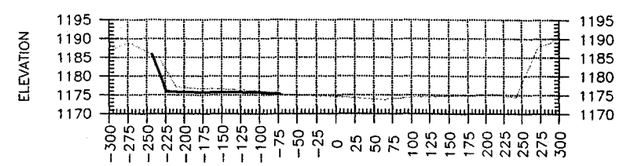
67+88



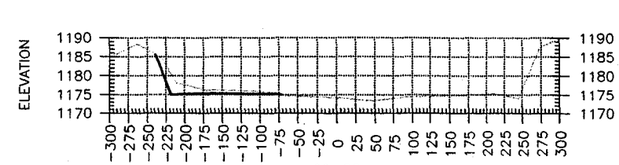
66+00



64+00



62+30



62+00

NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

MIDDLE NEW RIVER
WATERCOURSE MASTER PLAN
PROJECT NO. 28900058

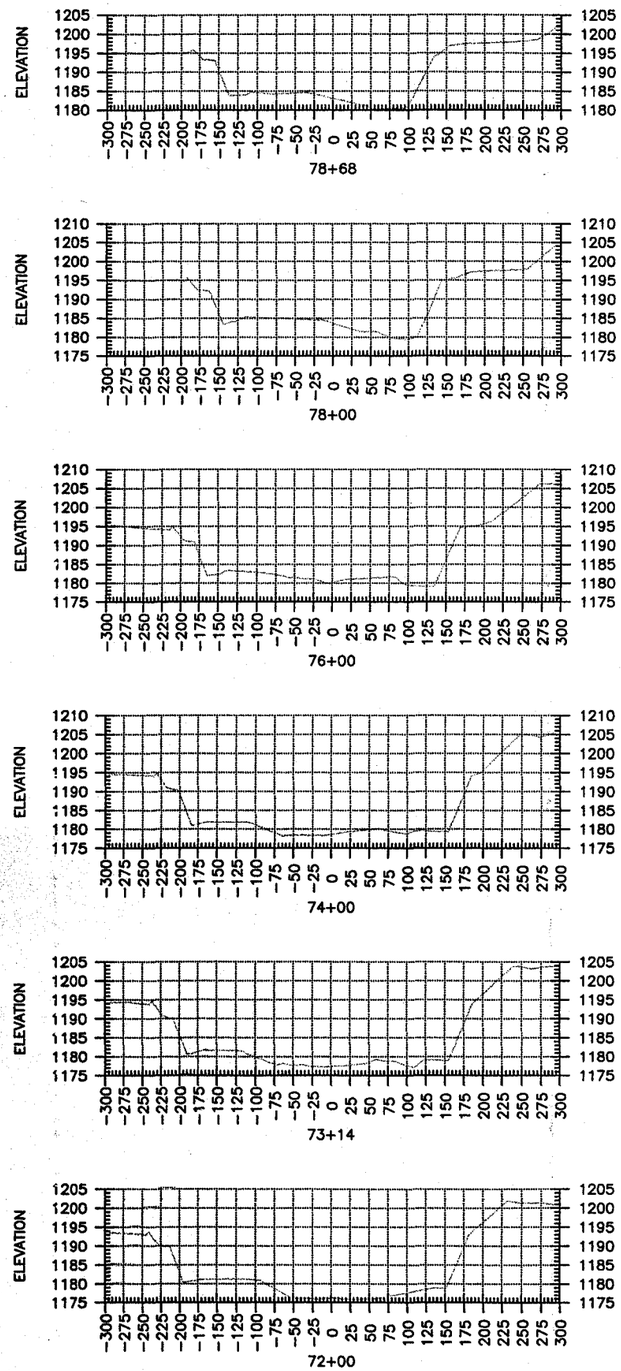
PRELIMINARY
NOT FOR
CONSTRUCTION

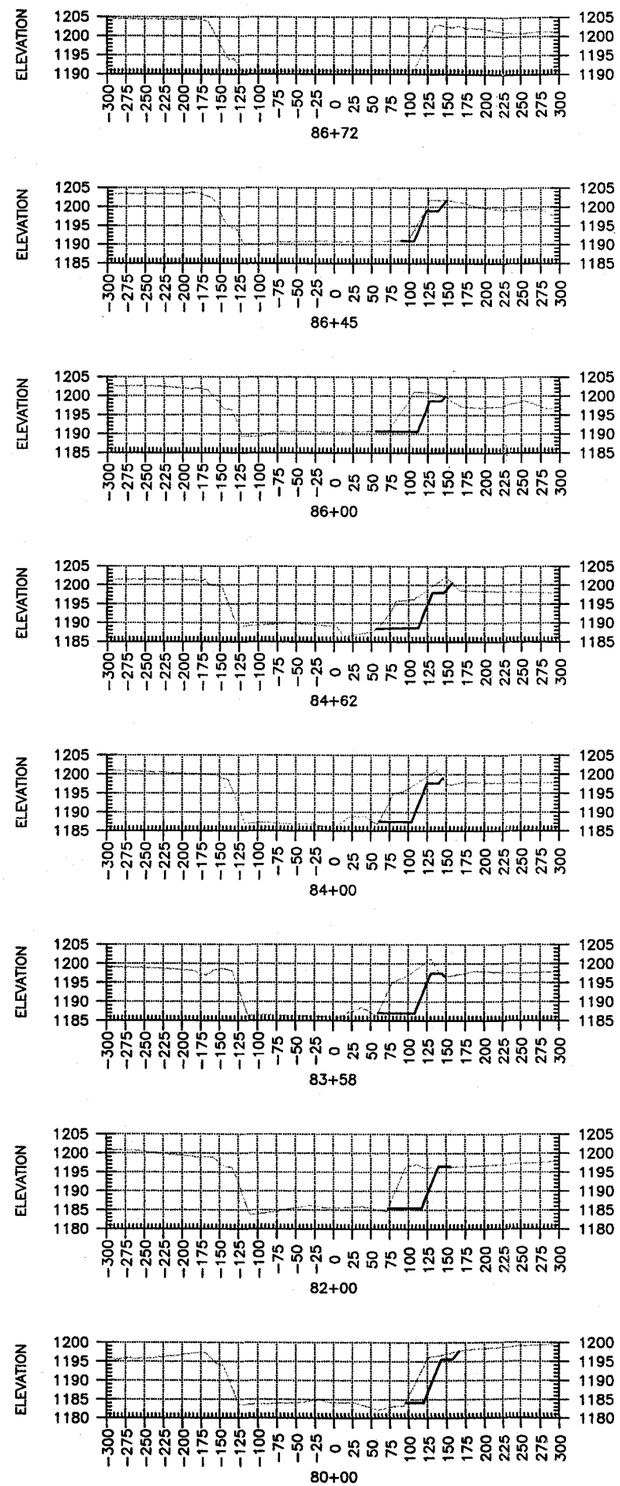
	BY	DATE
DESIGNED	C.A.S.	05/18/99
DRAWN	C.A.S.	05/18/99
CHECKED	S.S.S./P.J.E.	05/18/99

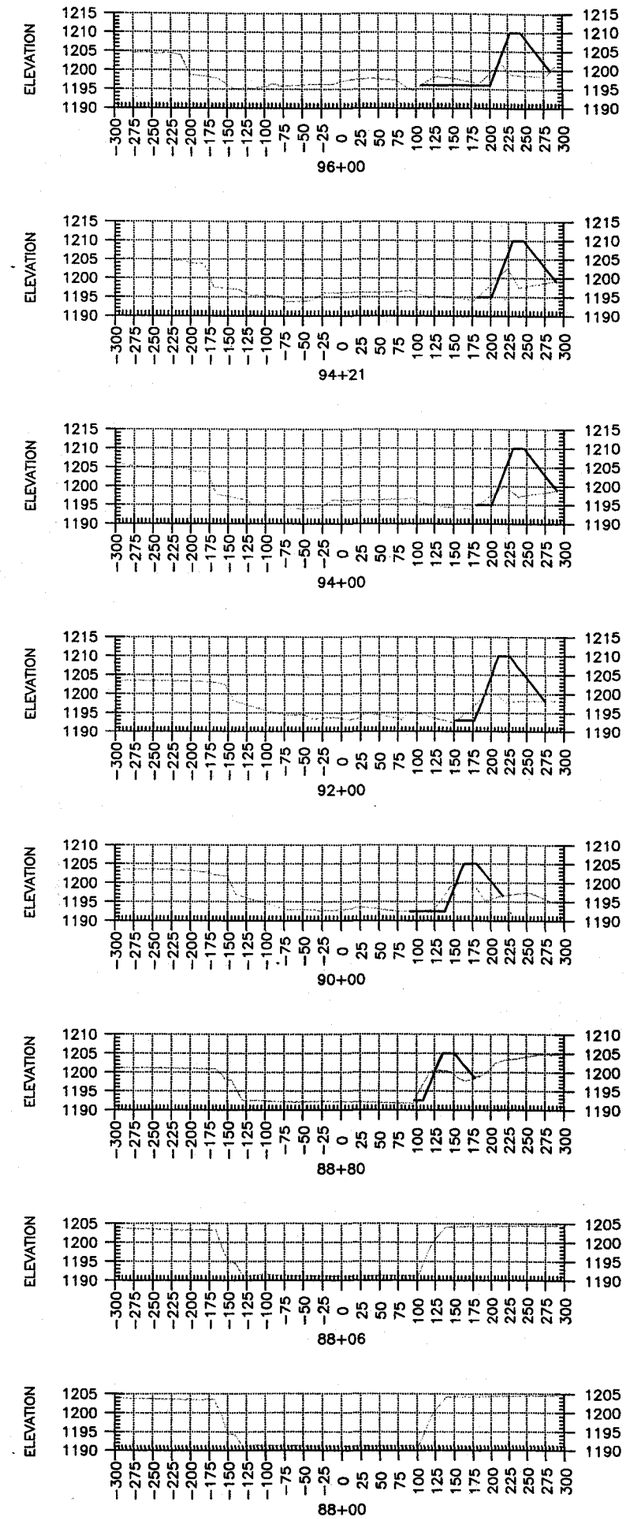
Stantec

CROSS SECTIONS
STA. 43+34 TO 70+00

SHEET 15 OF 23







NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

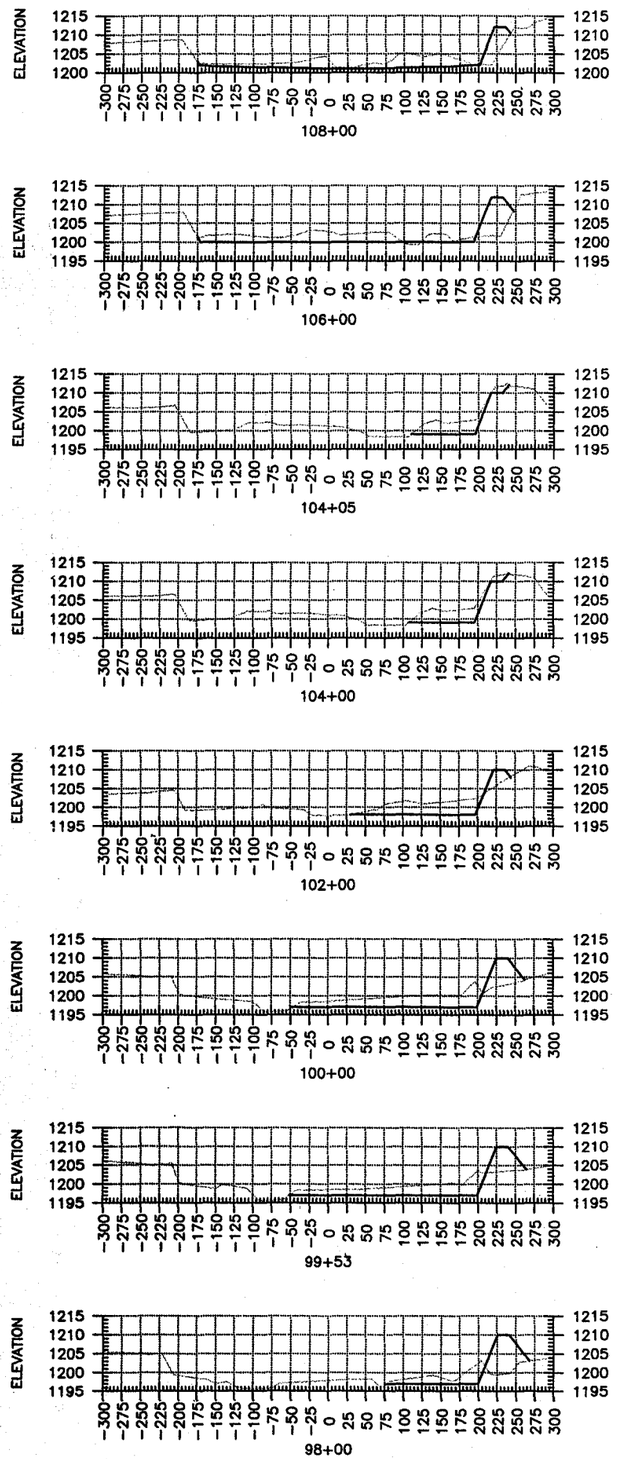
MIDDLE NEW RIVER
WATERCOURSE MASTER PLAN
PROJECT NO. 28900058

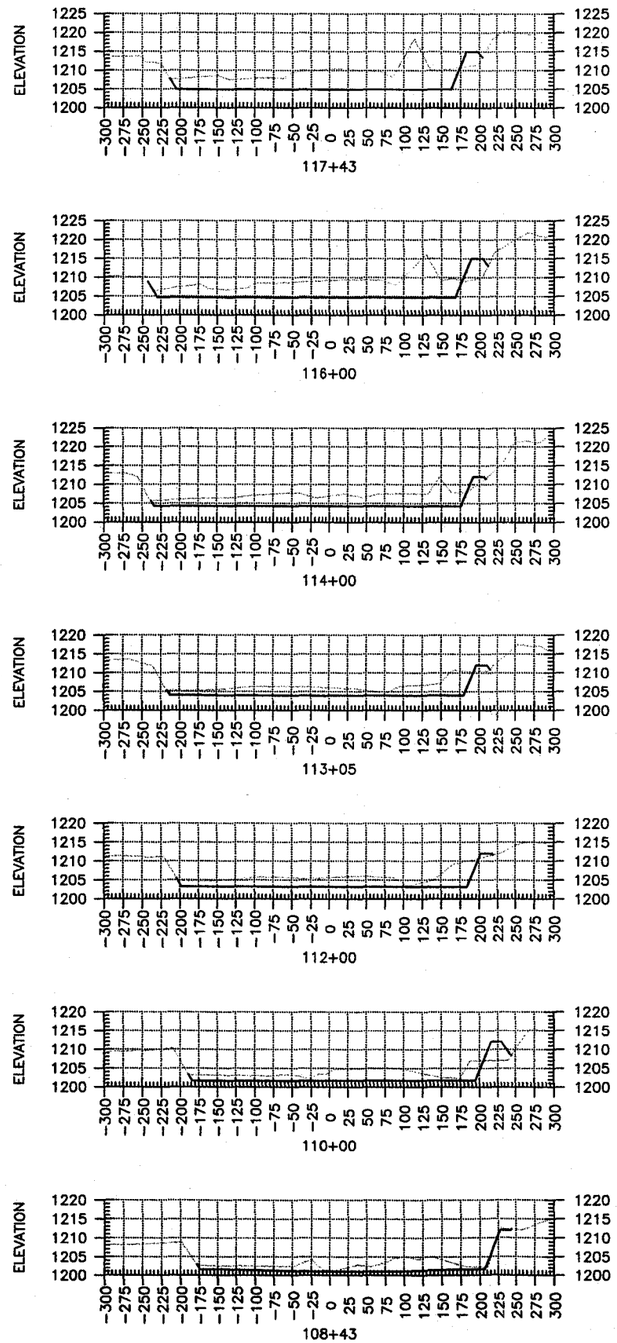
		BY	DATE
PRELIMINARY NOT FOR CONSTRUCTION	DESIGNED	C.A.S.	05/18/99
	DRAWN	C.A.S.	05/18/99
	CHECKED	S.S.S./P.J.E.	05/18/99

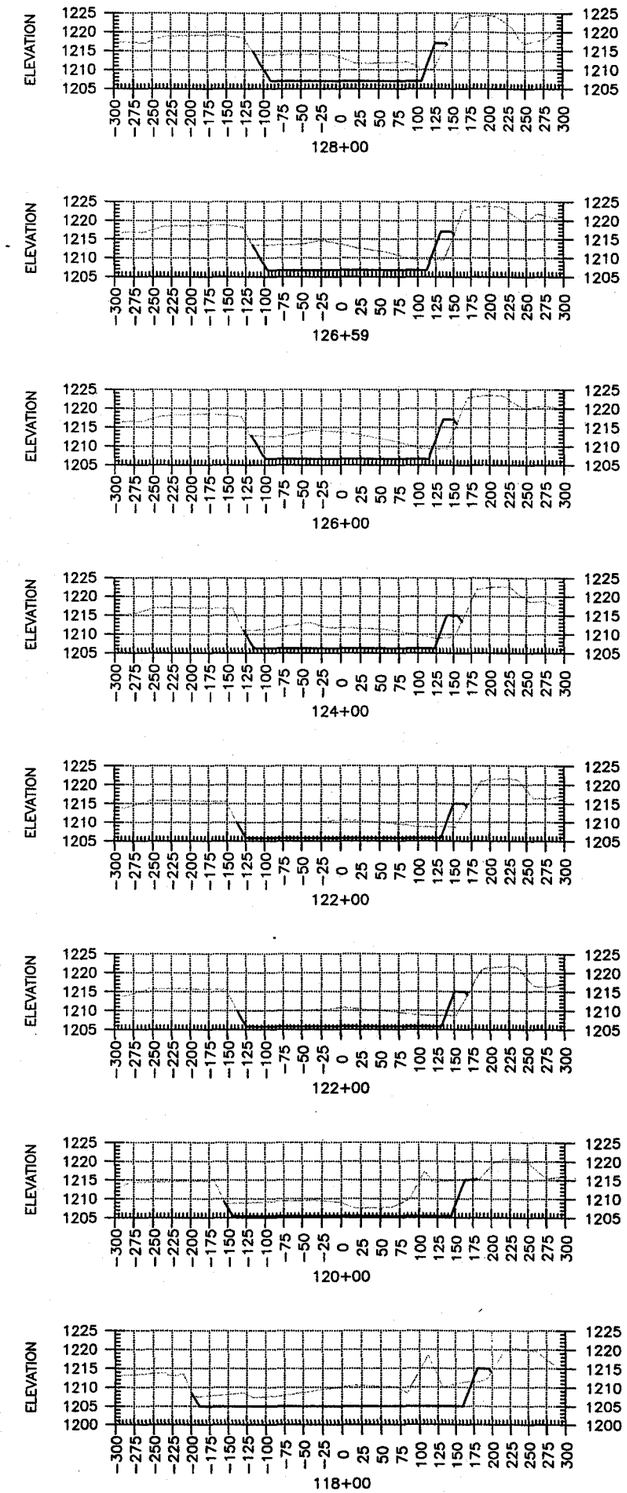
Stantec

CROSS SECTIONS
STA. 72+00 TO 96+00

SHEET 16 OF 23







NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

MIDDLE NEW RIVER
WATERCOURSE MASTER PLAN
PROJECT NO. 28900058

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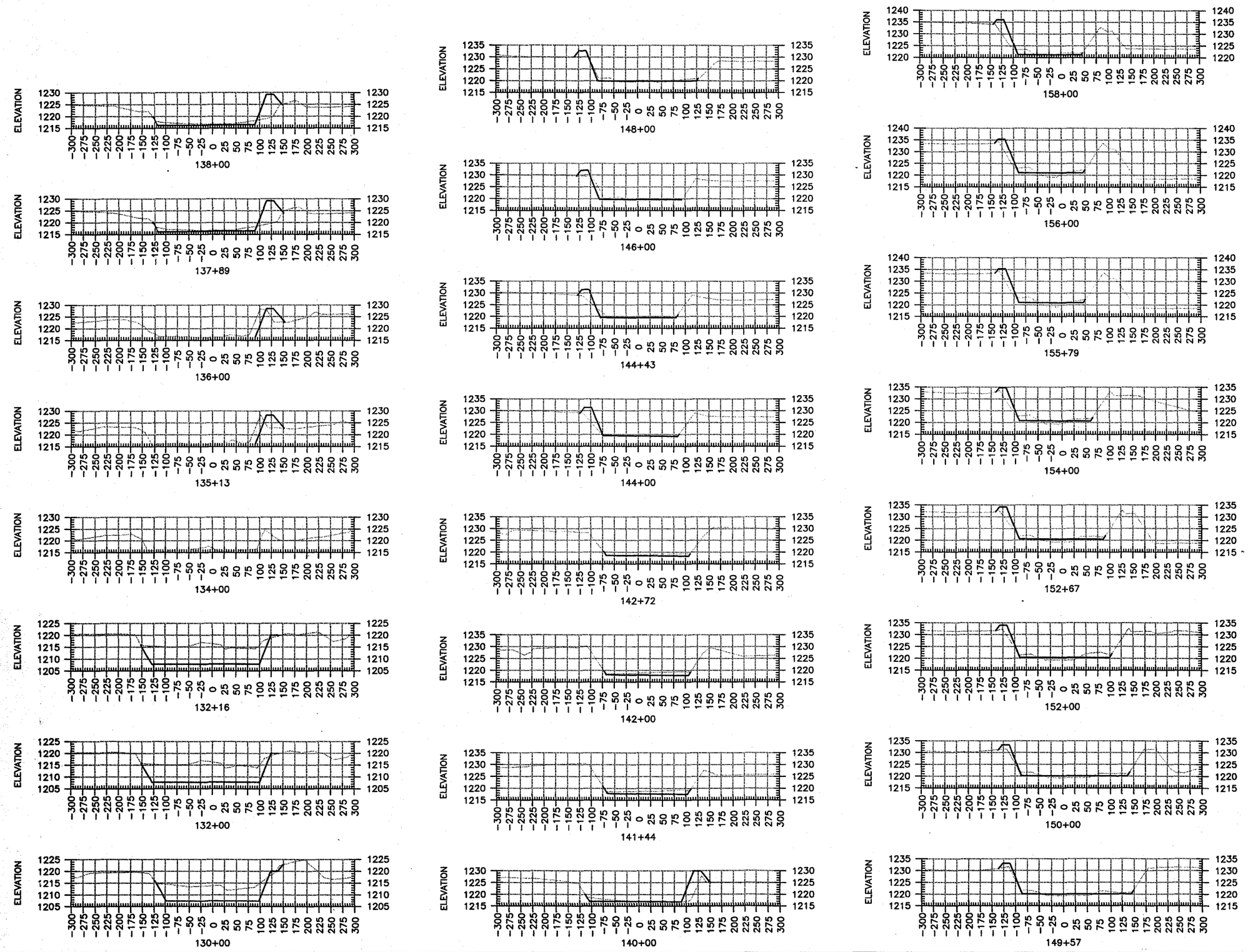
	CHECKED	S.S.S./P.J.E.	05/18/99

Stantec

CROSS SECTIONS
STA. 98+00 TO 128+00

SHEET 17 OF 23



NO.	REVISION	BY	DATE
3			
2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

MIDDLE NEW RIVER
WATERCOURSE MASTER PLAN
PROJECT NO. 28900058

	BY	DATE
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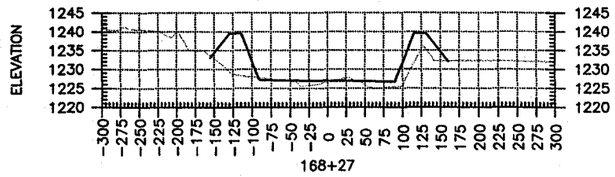
DRAWN	C.A.S.	05/18/99
CHECKED	S.S.S./P.J.E.	05/18/99

PRELIMINARY
NOT FOR
CONSTRUCTION

Stantec

CROSS SECTIONS
STA. 130+00 TO 158+00

SHEET 18 OF 23



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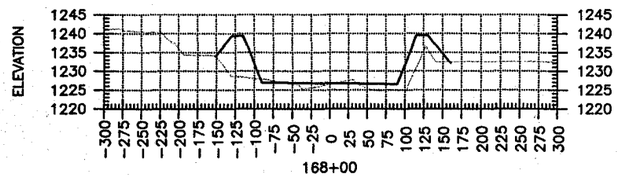
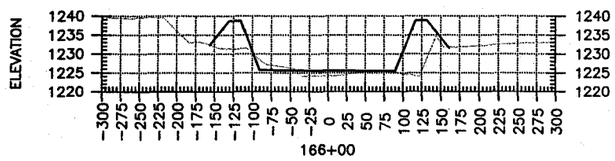
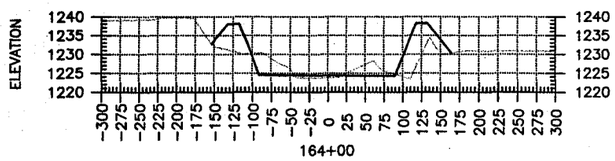


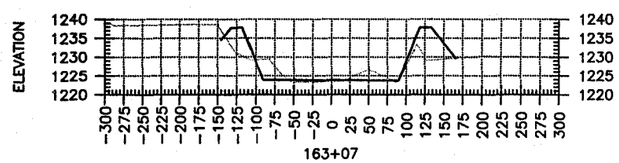
168+00



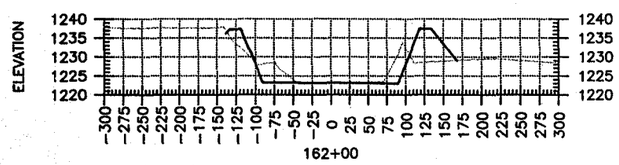
166+00



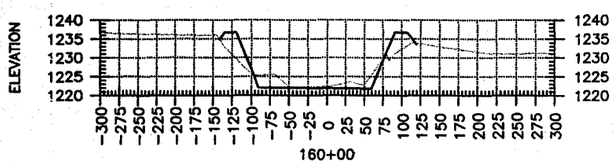
164+00



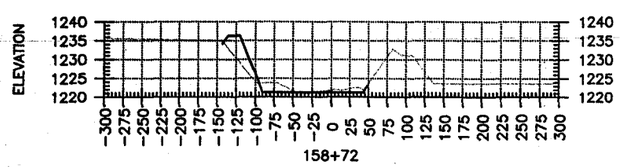
163+07



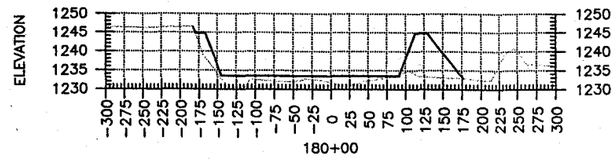
162+00



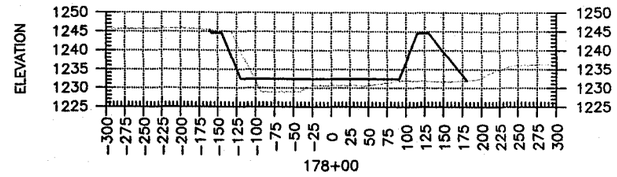
160+00



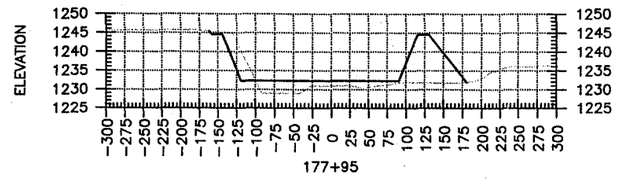
158+72



180+00



178+00



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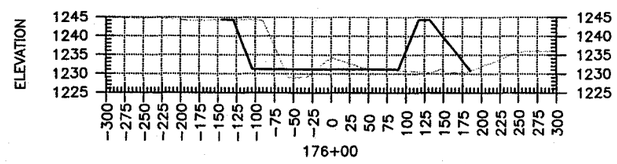
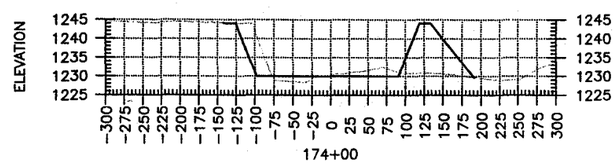
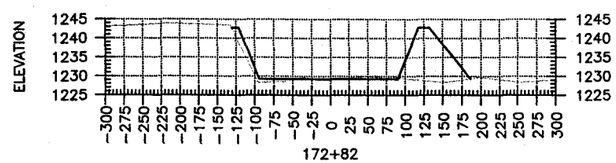


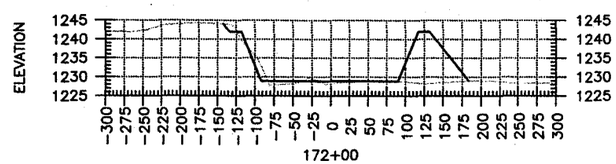
176+00



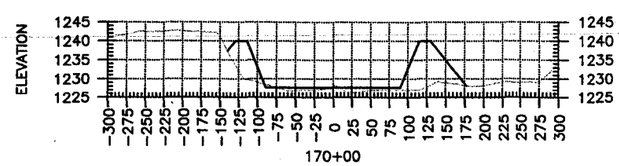
174+00



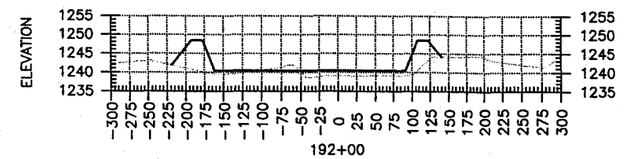
172+82



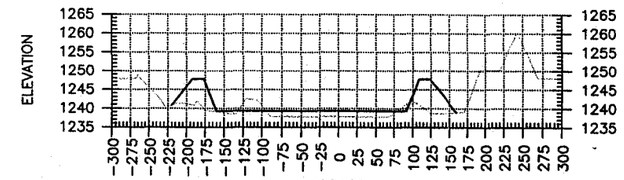
172+00



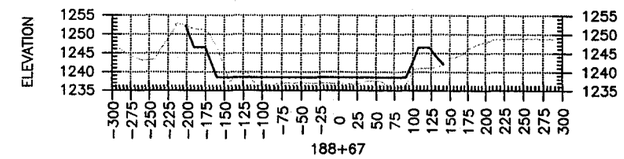
170+00



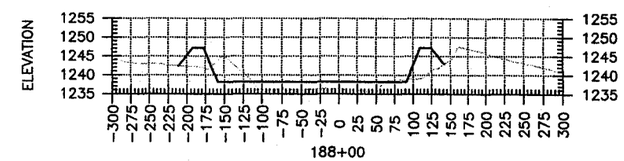
192+00



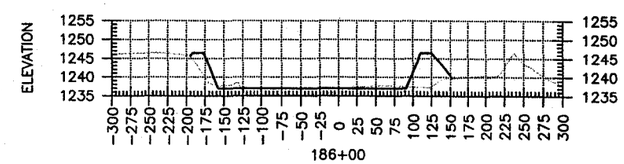
190+00



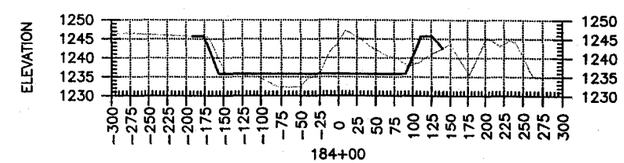
188+67



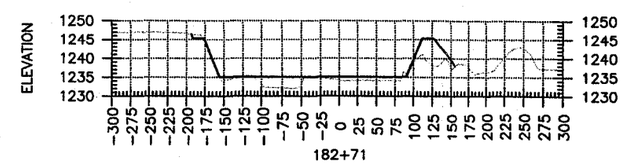
188+00



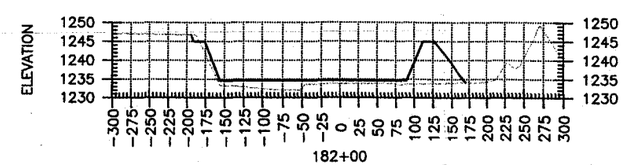
186+00



184+00



182+71



182+00

NO.	REVISION	BY	DATE
3			
2			
1	RED LINE CORRECTIONS	P.J.E.	01/10/00

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

MIDDLE NEW RIVER
WATERCOURSE MASTER PLAN
PROJECT NO. 28900058

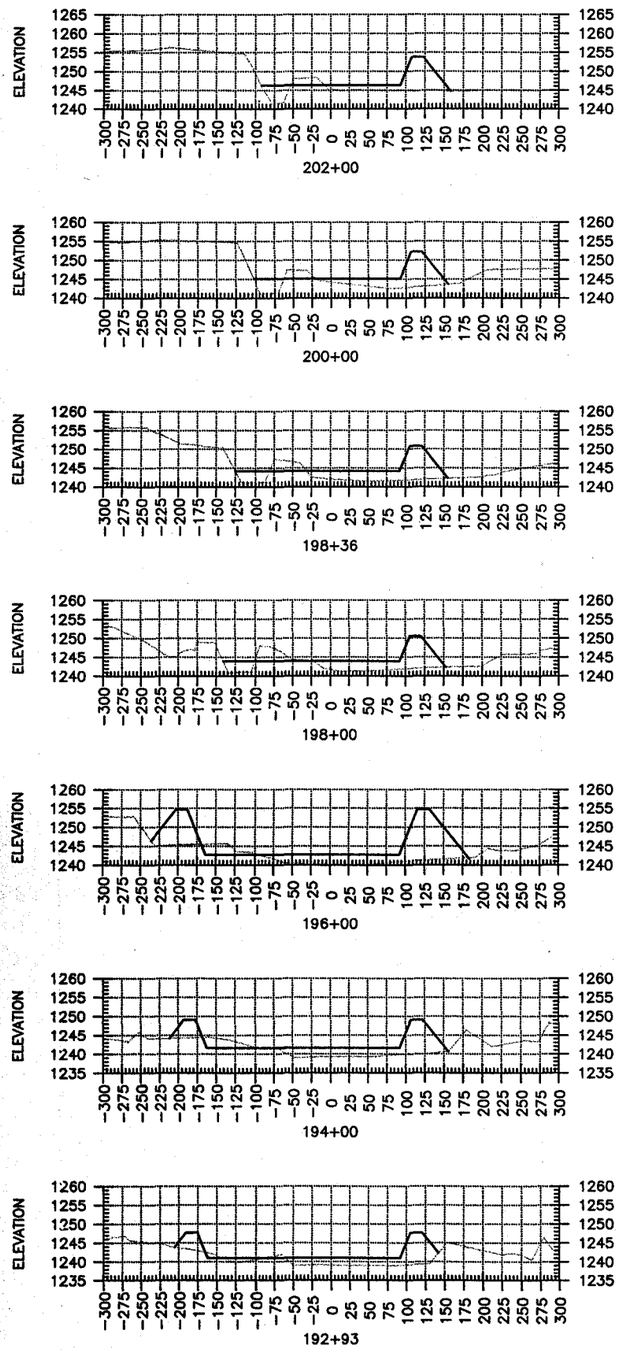
PRELIMINARY
NOT FOR CONSTRUCTION

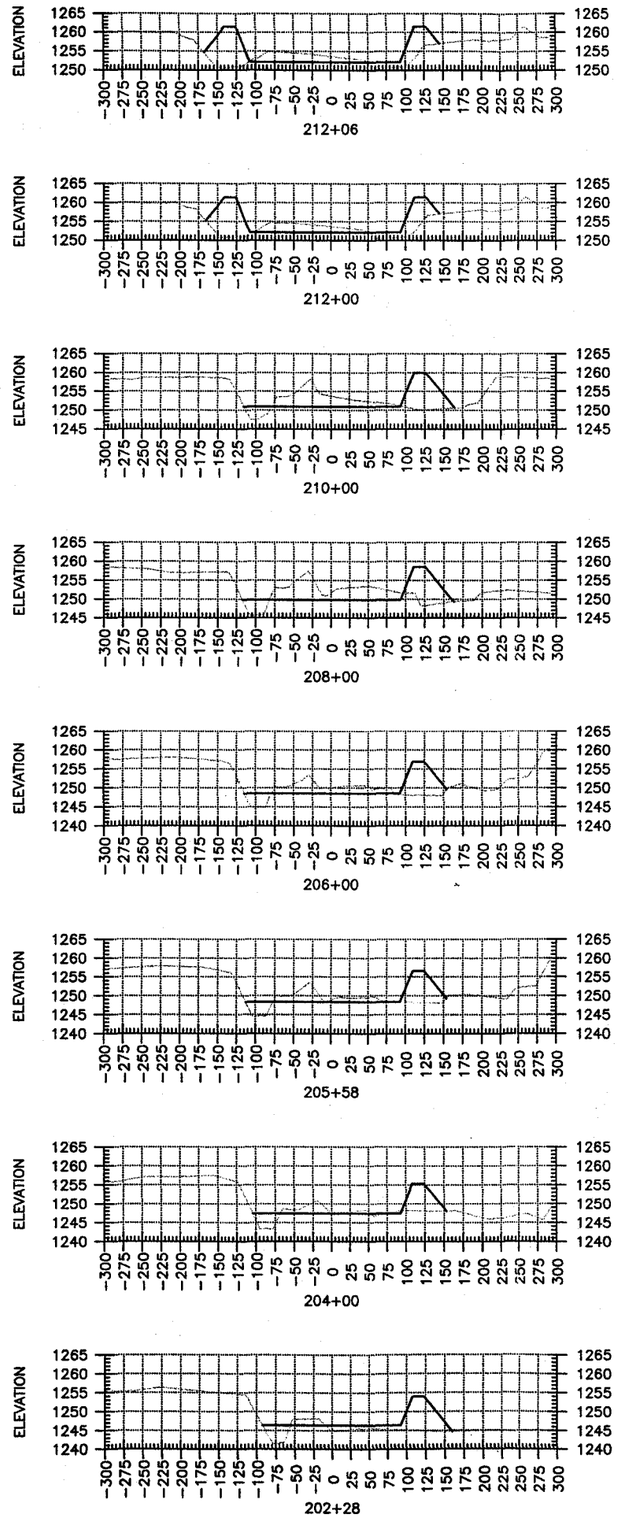
	BY	DATE
DESIGNED	C.A.S.	05/18/99
DRAWN	C.A.S.	05/18/99
CHECKED	S.S.S./P.J.E.	05/18/99

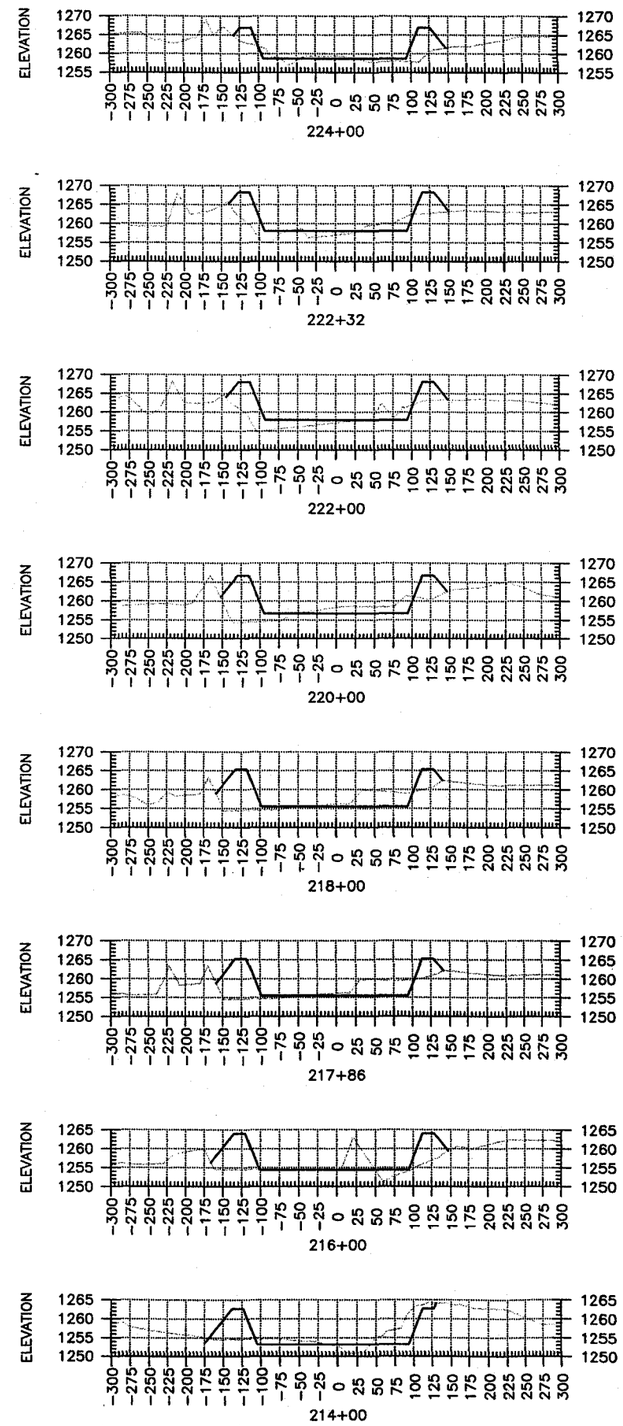
Stantec

CROSS SECTIONS
STA. 158+72 TO 192+00

SHEET 19 OF 23







NO.	REVISION	BY	DATE
3			
2			
1	RED LINE CORRECTIONS	P.J.E.	01/10/00

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

MIDDLE NEW RIVER
WATERCOURSE MASTER PLAN
PROJECT NO. 28900058

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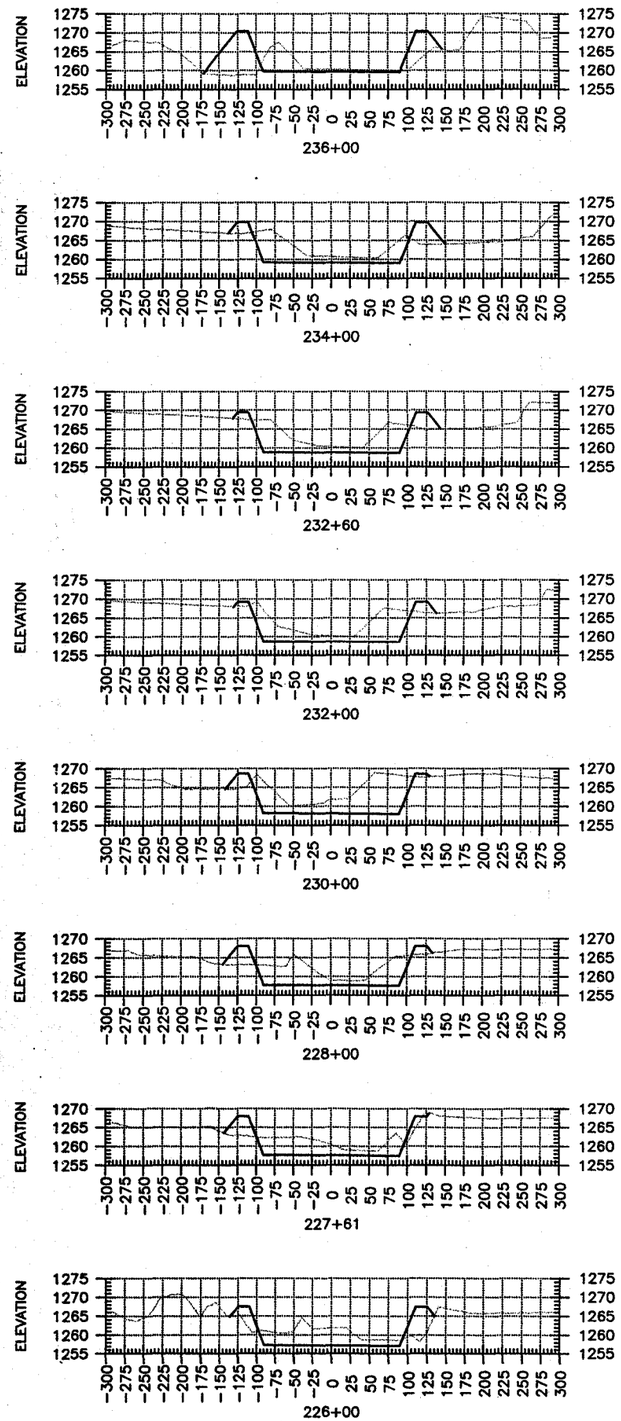
CHECKED	S.S.S./P.J.E.	05/18/99

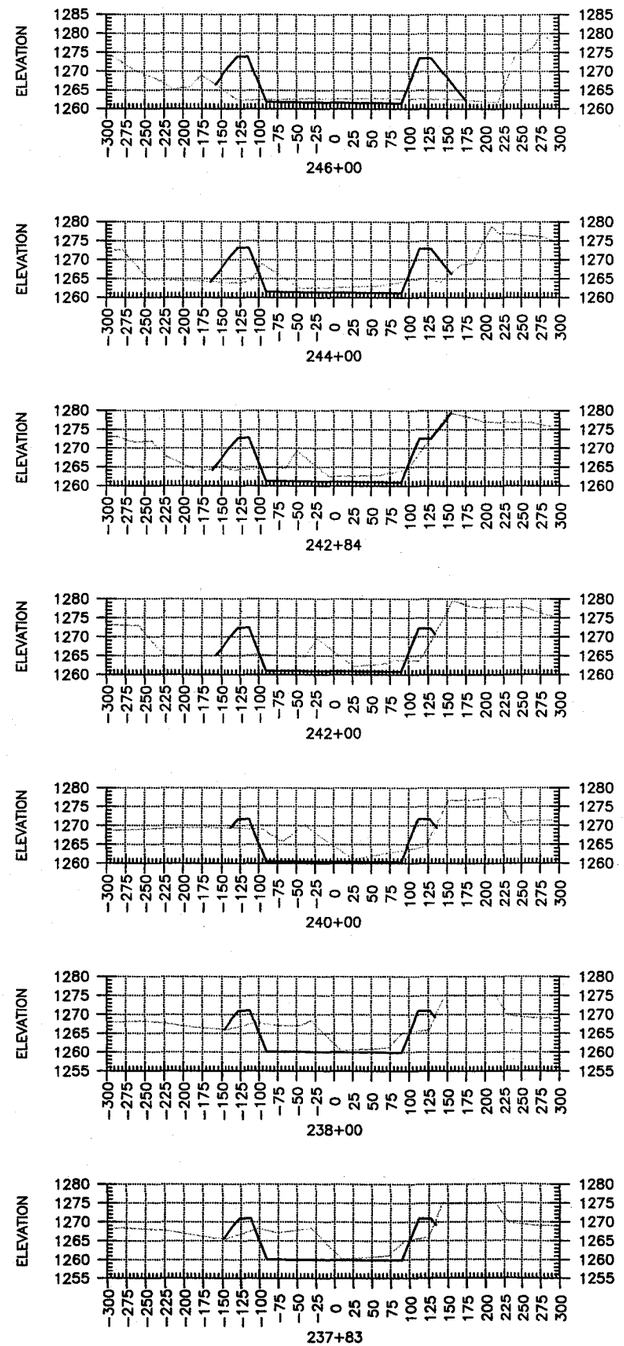
PRELIMINARY
NOT FOR
CONSTRUCTION

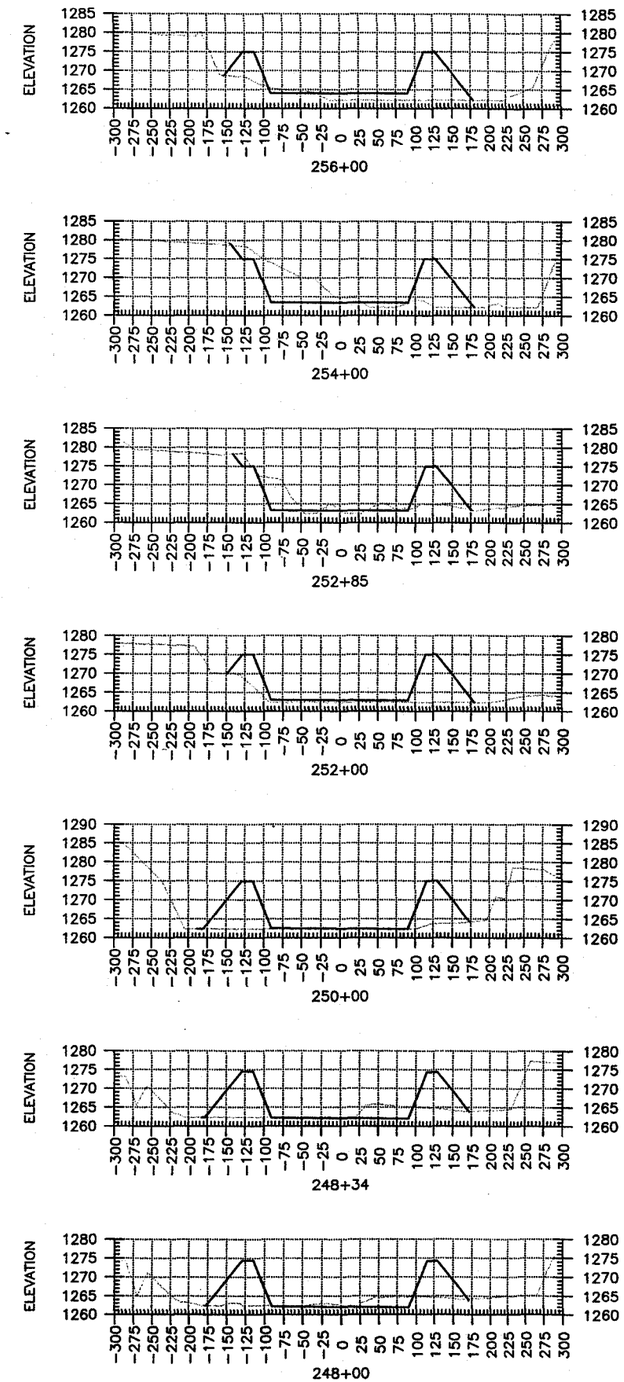
Stantec

CROSS SECTIONS
STA. 192+93 TO 224+00

SHEET 20 OF 23







NO.	REVISION	BY	DATE
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1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

MIDDLE NEW RIVER
WATERCOURSE MASTER PLAN
PROJECT NO. 28900058

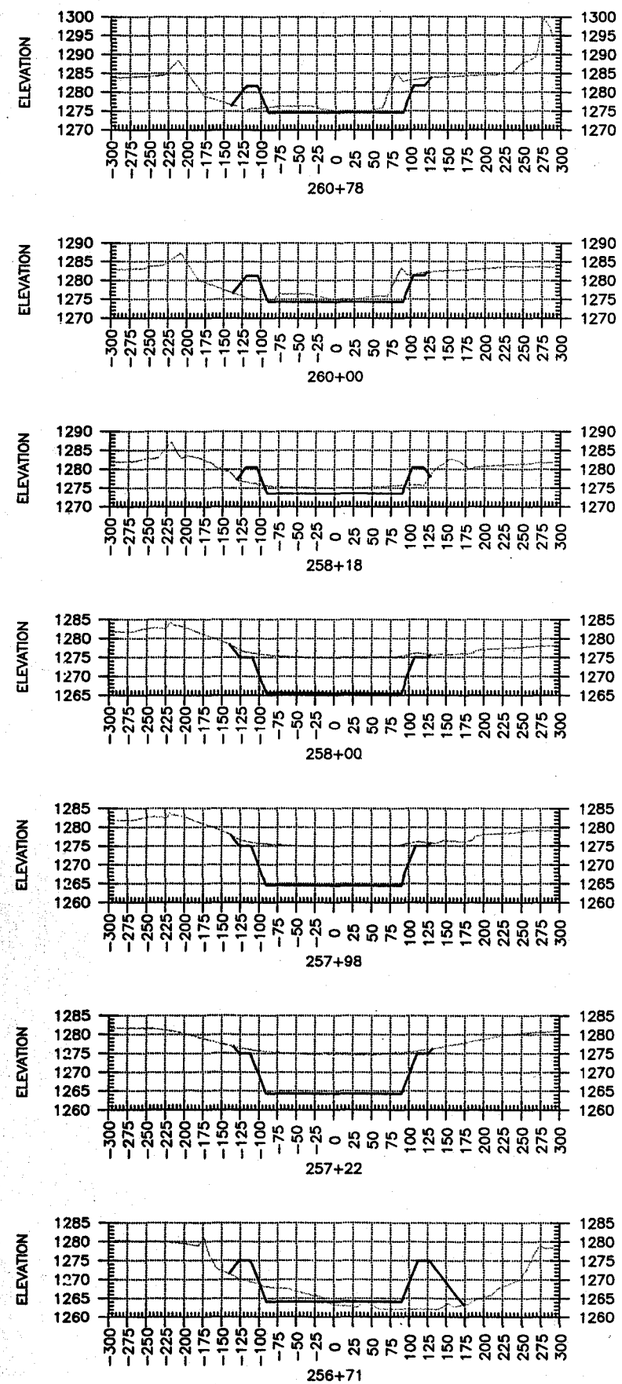
	BY	DATE
DESIGNED	C.A.S.	05/18/99
DRAWN	C.A.S.	05/18/99
CHECKED	S.S.S./P.J.E.	05/18/99

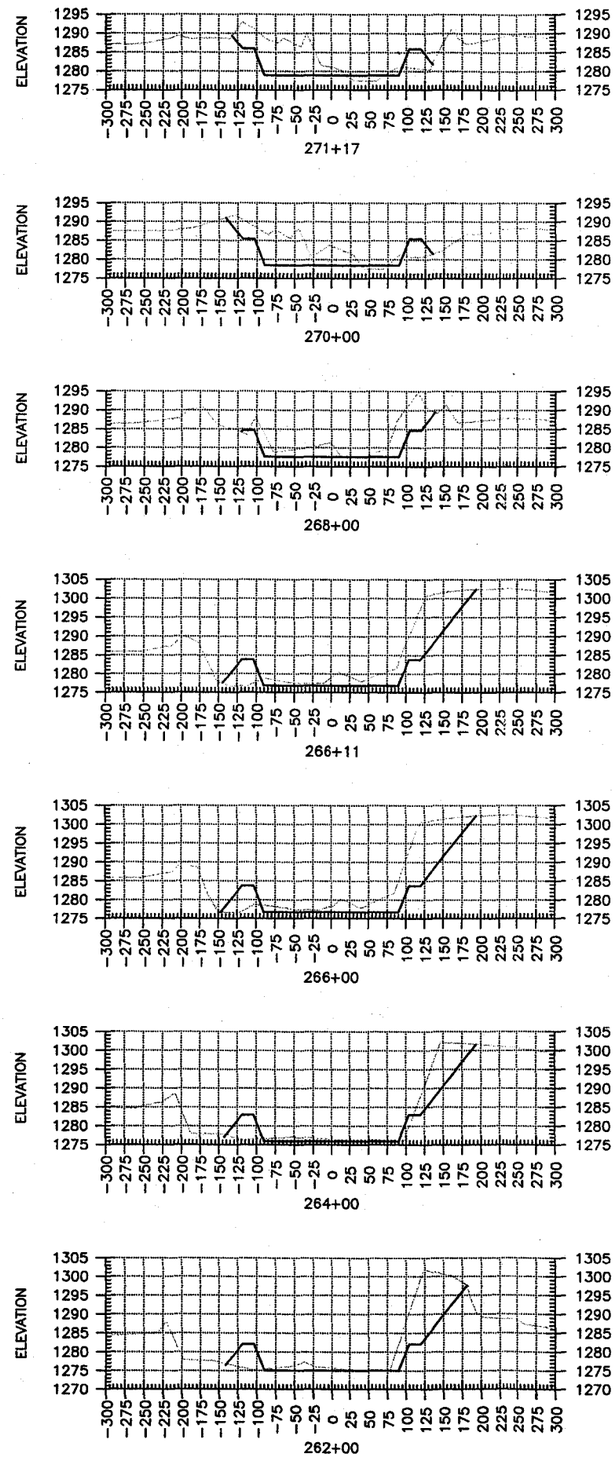
PRELIMINARY
NOT FOR
CONSTRUCTION

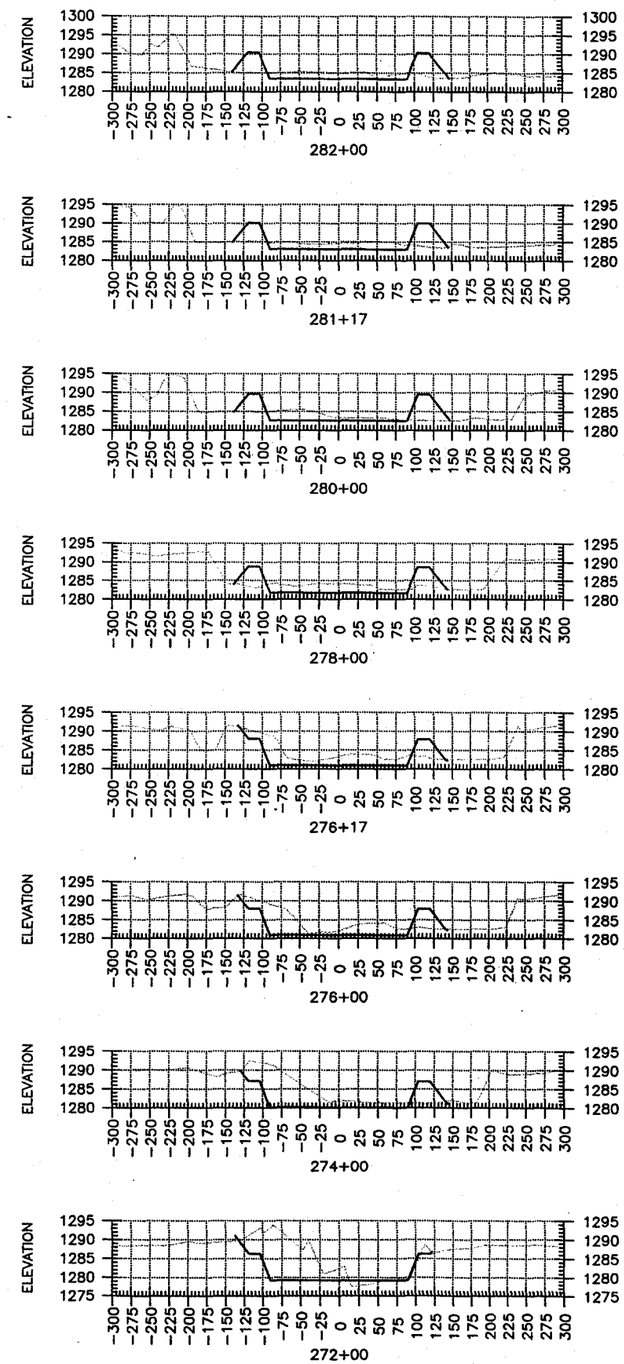
Stantec

CROSS SECTIONS
STA. 226+00 TO 256+00

SHEET OF
21 23







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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

MIDDLE NEW RIVER
WATERCOURSE MASTER PLAN
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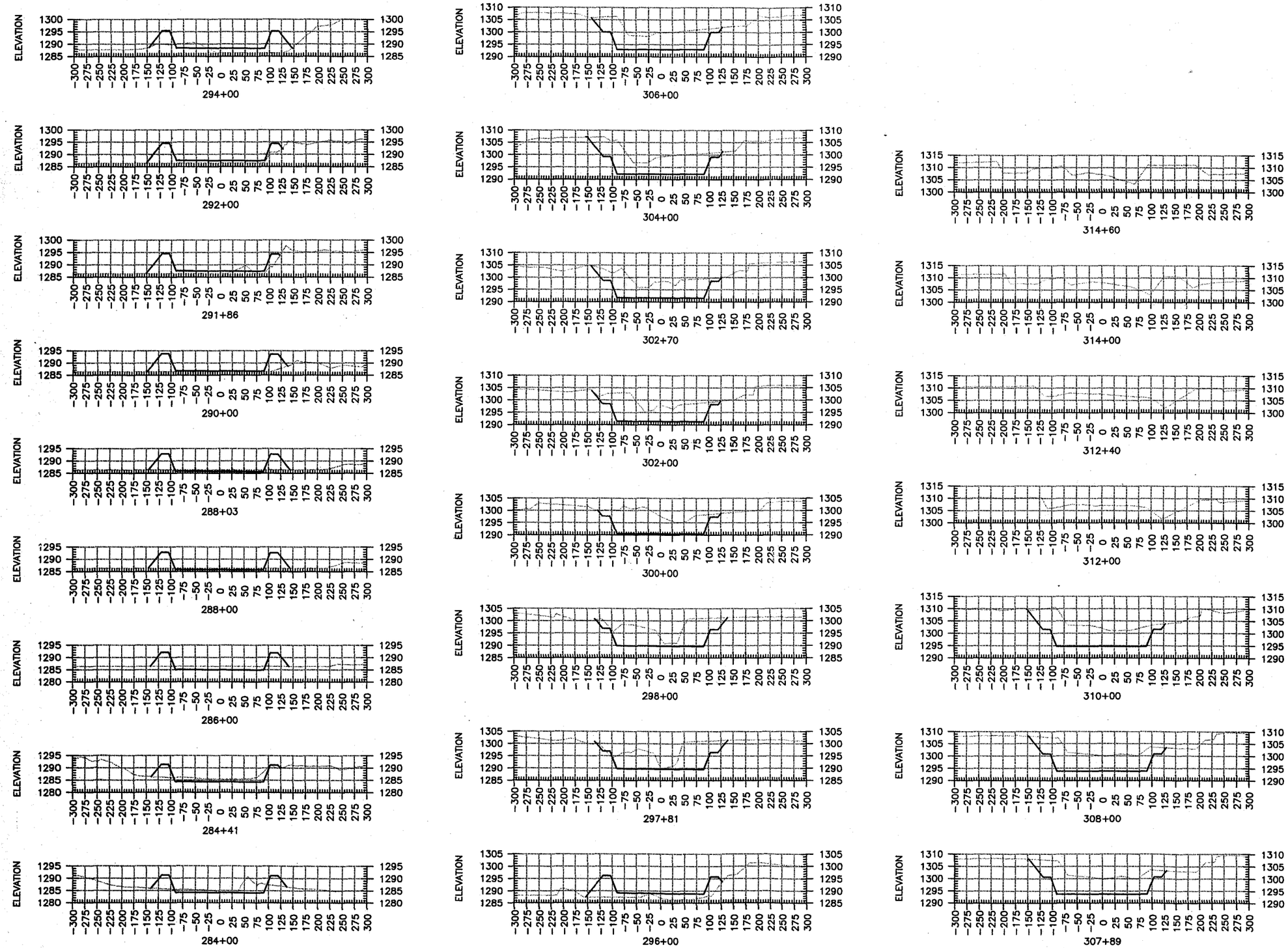
PRELIMINARY NOT FOR CONSTRUCTION	DESIGNED	C.A.S.	05/18/99
	DRAWN	C.A.S.	05/18/99
	CHECKED	S.S.S./P.J.E.	05/18/99

Stantec

CROSS SECTIONS
STA. 256+70 TO 282+00

SHEET 22 OF 23



NO.	REVISION	BY	DATE
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2			
1			

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
ENGINEERING DIVISION

MIDDLE NEW RIVER
WATERCOURSE MASTER PLAN
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PRELIMINARY NOT FOR CONSTRUCTION

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CROSS SECTIONS
STA. 264+00 TO 314+60

SHEET OF 23 23