MASTER DRAINAGE REPORT

PALMER PARK AREA

COLORADO SPRINGS, COLORADO

APRIL 1972

KARCICH & WEBER, INC.

Engineers - Planners - Consultants

COLORADO SPRINGS, COLORADO

Mr. DeWitt Miller
Director of Public Works
City of Colorado Springs
Colorado Springs, Colorado

Dear Mr. Miller:

Transmitted herewith are five (5) copies of our master drainage report for the Palmer Park Drainage Basin in the north central portion of Colorado Springs, as authorized by the City Council in February, 1972.

Our proposed master drainage report, together with preliminary plans and cost estimates, is the product of a completely revised hydrologic engineering study of sub-basins 2 through 8 as found in Henningsen, Durham and Richardson's original "preliminary design" for the same area, dated September 1961.

We have enjoyed preparing this report for you and are available to answer any questions you may have.

Very truly yours,
Karcich & Weber, Inc.

William P. Weber

M. Akse

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ACKNOWLEDGEMENT

We wish to express our appreciation for the outstanding cooperation received from Mr. George Jury, Mr. Robert Martin, Mr. Richard Ernster, and others on the staff of the City Engineer's office, in compiling engineering data needed for this hydrologic engineering study.

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GENERAL:

The Palmer Park Drainage Area is located in the central or north-central portions of Metro. Colorado Springs. The area is bounded by Summit Drive and Palmer Park on the north, Union Blvd. on the west, Uintah Street on the south, and it extends nearly to Academy Blvd. on the east. All runoff from the area eventually collects in the upper part of Shooks Run immediately west of Union Blvd. and north of East Junior High School, from which point it runs into a small retention reservoir located in Patty Jewett Municipal Golf Course.

The necessity for a storm sewer system for the area was first realized more than ten years ago, and a preliminary storm sewer system was designed in 1961 and presented in a report by Henningsen, Durham and Richardson. It is interesting to note that at that time the area was described to be located in the northeastern portion of Colorado Springs, while today it is located geographically closer to the central part of the city, due to the rapid growth of the city the last 10 years.

The total Palmer Park drainage basin as described above comprises about 1,185 acres, while only 1,040 acres were restudied in this report. The remaining 145 acres, the shaded areas on the proposed master plans enclosed herewith, were not restudied because no changes have occurred in these areas to warrant such restudy. The updated study was necessary mainly because of the installation of an undersized 78" diameter equivalent elliptical pipe under Union Blvd. from the alley between LeLaray Street and Mt. Vernon Street to Shooks Run.

EXISTING STRUCTURES:

Following is a list of drainage structures presently in the ground in the part of Palmer Park Drainage Basin restudied for this report, with brief comments on their adequacy:

1) 63" x 98" elliptical RCP from alley east of Union Blvd. between LeLaray Street and Mt. Vernon Street to an open concrete channel at the upper part of Shooks Run immediately west of Union Blvd. The original report called for a 108" pipe for this location, which, if installed, would have been capable of handling the anticipated flow from the design storm. Instead, the 63" x 98" elliptical can handle only about 43% of the total expected flow.

2) Two 58" x 36" CMP arches across Union Blvd. straight east of Shooks Run. These two pipes are capable of handling roughly 46% of the estimated total flow less the capacity of the above-mentioned elliptical RCP.

3) Roughly 1000 feet of 24" and 18" pipes and a total of six catch basins serve the parking lot for Arlan's Department Store east of Union Blvd. These pipes drain into the two above-mentioned arch pipes and are considered adequate to handle the drainage for the area they serve.

4) An open unimproved (dirt) ditch in the alley between LeLaray Street and Mt. Vernon Street approximately 15 ft. wide at the bottom with 1.5:1 side slopes and 4'-5' deep running from the 63" x 98" elliptical pipe mentioned under (1) east to Tweed Street. This ditch is considered capable of handling more than twice the amount of runoff contributed to it after the completion of construction of the proposed pipes in this report.

5) A concrete bridge on Tweed Street immediately east of the above-mentioned ditch. This bridge is adequate to handle more runoff (underneath) than expected to be contributed to it.

6) A 72" RCP in the same above-mentioned alley running from Tweed Street to McArthur Street, with one drop inlet with grating in Eagle View Drive, and a 72" CMP connected to the RCP in McArthur Street and running north in McArthur Street to LaSalle Street, east from there to an easement halfway between McArthur Street and Howard Street north through the easement and east for one-half block south of the CRI&P railroad tracks to Howard Street. At that point there is an intake structure from a

concrete-lined rectangular channel crossing underneath the railroad tracks. This intake is considered inadequate and will need to be reworked in order to provide the geometrics necessary to allow capacity flow to enter the 72" CMP at that inlet point. At the present time a detrimental amount of water jumps the inlet after a major rainstorm and floods the streets and properties downstream from it. At the intersection of LeLaray Street and Mt. Vernon Street is the location of a 4-ft. curb inlet. This curb inlet combined with the intake structure and the drop inlet in Eagle View Drive are still considered incapable of supplying the 72" pipe to capacity.

7) Two pipes feed into the above-mentioned concrete-lined rectangular channel north of the railroad track. One, a 29" x 18" CMP arch, is supplied by runoff water from Wasson High School. The other, a 24" CMP, drains street runoff from the north side of Constitution. Both are adequate combined with a small curb spillway draining into the rectangular channel from the south curb of Constitution.

8) North of the railroad track and parallel to it is a concrete-lined triangular channel 4 ft. deep and 18 ft. wide at the top connecting to the above-mentioned rectangular channel on its west side and beginning at the southwest side of the intersection between North Circle and Constitution. This channel is capable of handling the runoff contributing to it.

9) The above-mentioned triangular channel is fed by two storm drainage culverts. One extends north to a 40-ft. long, 1-ft. wide drop inlet and two curb inlets, one on either side of North Circle immediately north of Constitution. The other one an 18" culvert extends easterly across North Circle. Neither of these culverts, nor their inlets, are capable of relieving adequately the runoff from the street.

10) An open rectangular asphalt-lined channel 6'± wide and 8"± high runs easterly from the above-mentioned 18" culvert parallel to and north of the railroad track to Alpine Drive, at which point it arcs to the north to pick up curb flow from the south curb of Constitution.

11) Along the north curb of Constitution at Alpine Drive there are five curb inlets and one drop inlet feeding a 58" x 36" CMP arch siphon that runs south to a curb outlet located at the west curb of Alpine Drive straight west of LaSalle. This siphon relieves the surface water otherwise flowing across Constitution at this low point to a degree; however, the problem of street flooding is not solved, but rather moved downstream.

12) Another siphon, pipe size unknown, is located across North Circle. One curb inlet picks up some curb flow from the south curb of Alpine Street and the outlet is located at the south curb of LeLaray Street across North Circle. This siphon is inadequate and, furthermore, tends to move the street flooding problem downstream as mentioned above. A few culverts not mentioned above are known to be in the ground in the basin and some may not have been detected from our field study. However, they do not contribute to the solution of the overall drainage problem of the area and are therefore not discussed in this report.

Needless to say, the runoff water not handled by the existing drainage structures will find its own way downstream, as streetflow, through alleys, over sidewalks and lawns, and frequently into basements.

For easier reference to the location of the existing drainage structures, see the black broken lines on the enclosed proposed master plans.

PURPOSE AND SCOPE:

The Colorado Springs area is classified as semi-arid with low average annual rainfall. However, it is subject to short-duration, high-intensity rainstorms with subsequent high peak runoff. In the last couple of years alone the city has experienced numerous rainstorms with subsequent detrimental consequences from runoff in areas with inadequate storm drainage facilities. Residents in the Palmer Park drainage basin have suffered those consequences annually. And so have the taxpayers of Colorado Springs. As an example of the latter statement, the Public Works Department of Colorado Springs spent $60,000 for cleanup and damage repair after the spring and summer rainstorms of 1961 alone; not to mention damage and cleanup to private property. Today the same cleanup and repair would probably have cost the taxpayers in the neighborhood of $100,000.

In addition to the above-mentioned expenses caused by flooding, there are the numerous inconveniences, delays, frustrations, and hardships to residents that can hardly be measured in terms of money.

In light of all this, it is the intention of this study to develop a system of storm sewers in the Palmer Park drainage basin that will combine economy of construction with a reasonable relief of flooding events from rainstorms. Consequently the proposed storm drain system as found on the master plans herein is not expected to give 100% flooding relief from any occurring rainstorm, but rather adequate relief from all rainstorms and complete relief from the most frequent ones. The next section is intended to give some indication as to which frequency storms the proposed storm drainage system is designed to give complete flooding relief for.

Furthermore, since there is not sufficient funds available to pay for the construction, surveying, and engineering design of the entire project in one year, it has been necessary to break the project into several phases of construction. These phases are based on yearly funds available and priorities of flooding relief combined in an attempted optimal solution from a logical hydrology and sequence viewpoint.

Four proposed master plans are submitted herewith, consisting of two cases with two alternative alignment locations of storm sewers for each case. The two cases were necessitated because of the uncertainty at this time of the amount of money available for each phase. Case I indicates the extent of construction possible for each phase based on

the following budgeted money to include construction cost, engineering design, surveying and inspection as obtained from the City of Colorado Springs Engineering Department:

Phase I	1972	$285,000
Phase II	1973	$150,000
Phase III	1974	$100,000
Phase IV	1975	$100,000
Phase V	1976	$200,000
Phase VI	1977	$200,000
Phase VII	1978	$200,000
Phase VIII	1979	$200,000
Phase IX	1980	Not yet budgeted.

Case II likewise indicates the extent of construction possible for each phase based on the passing of the 1% sales tax, in which case the City of Colorado Springs Engineering Department informed us of the following possible budget for palmer Park:

Phase I	1972	$285,000
Phase II	1973	$300,000
Phase III	1974	$200,000
Phase IV	1975	$200,000
Phase V	1976	$400,000
Phase VI	1977	$400,000
Phase VII	1978	$400,000

The two alternatives for each case are thought necessary because Alternative I, the most economical alternative from a construction viewpoint, will require the acquisition of right-of-way at two locations. One will be needed through the parking lot at Arlan's Department Store east of Union Blvd. for the proposed 90" pipe. The other R.O.W. will be needed from San Carlos Circle north to Chelton road for a 21" pipe. The economics of obtaining these ROW's are presently unknown; therefore, an alternative alignment location is included on the proposed master plans (Alternative II) for each case.

The estimated costs for each phase, one for each of the four proposed master plans, are included as part of this study.

Finally, the scope of this study is to present the proposed solutions for the storm drainage system in a manner which enables the reader to visualize the results in the easiest possible way. Consequently we chose to present each proposed phase (for each alternative in each case) in different colors on the master plans. Furthermore, in the possibility that it should be chosen to, or necessary to, make any alterations from the proposed plans,

transparent overlay sheets are enclosed on the top of the master plan sheets depicting the anticipated total flow of water and the amount of flow in the pipe for the chosen rainstorm. It may be assumed within reason that any other storm, be it more or less severe than the design rainstorm, will produce runoffs at any point in the basin which are comparable to the ones found on a ratio basis from point to point.

DESIGN CRITERIA:

A. Introduction:

In the analysis and computation of runoff to be used as a basis for sizing storm sewers, it is necessary to make two decisions. First, the frequency of the design rainstorm has to be established. Second, the method of computing the runoff from the design storm must be chosen.

Statistical correlations are available between the frequency of a storm for a given general area of the U.S.A. and the storm's expected intensity, revealing the general concept that the storms recurring frequently are of lesser intensity than the ones recurring less frequently. Thus a 5-year rainstorm is one that statistically is expected to recur at an average of once every five years, while a 50-year rainstorm (much more severe than the 5-year) is one that statistically is expected to recur once every 50 years. The more rainfall data that has been collected for a certain area, the more reliable the statistical analysis and thereby the intensity for each frequency storm. Likewise, if no rainfall data is available for a certain drainage basin, one has to assume data to apply for a basin close by or for the general area whichever is available. For the purpose of this study, since no data is available specifically for the Palmer Park drainage basin, data compiled for the general Colorado Springs area has been used. This data was compiled by the Weather Bureau of the U. S. Department of Commerce and reproduced in Rainfall-Intensity-Duration-Frequency Curves. These curves are shown on figure I in the appendix of this report.

B. Design Storm:

As set forth in the previous section, PURPOSE AND SCOPE, the basis for the design of the storm sewers in this report is the concept of allowing occasional minor flooding, while sizing the storm drainage facilities for maximum use. Thus a 5-year frequency storm has been used to size the storm sewers. On an average then, this means that once the storm sewer system is completely installed, some minor street flooding theoretically could occur once every five years. However, the storm sewers are not sized to carry all runoff water from the 5-year storm; they are designed to carry all runoff less a maximum of 20 CFS which will have to be carried by the streets in the area. Thus, when a lower frequency (higher intensity) rainstorm does occur, the streets will be able to carry roughly three times as much water as they do during the five-year storm, and the flooding will in

most cases not be detrimental, but rather an inconvenience to motorists and pedestrians for a short period of time.

C. Method of Computation:

The method used to determine the amount of runoff from the 5-year rainstorm is called the Rational Method. This method combines four factors in a formula (the Rational Formula), as follows: $Q = C\,I\,A$ where

Q is the amount of runoff in cubic feet per second at the point in question
C is the runoff coefficient
I is the intensity of rainfall in inches per hour
A is the tributary area of the sub-basin in acres.

(1) The runoff coefficient C is by definition the ratio of the amount of runoff water reaching the point in consideration to the total amount of rainfall. This factor is affected by the soil type, the relative amount of imperviousness of the surface in the area, and the antecedent condition at the time of the rainfall as well as temperature and vegetation. When the type of soil is known an estimate can be made of what capacity the soil has to absorb water (infiltration). The temperature affects the amount of rainfall that will evaporate and the vegetation affects the transpiration. The antecedent condition affects the degree of saturation of the soil prior to the rainfall in question and is therefore dependent on the time lag between that rainfall and the preceding one. This factor will affect the infiltration capacity of the soil. For a developed area, like the Palmer Park drainage basin, a large portion of the soil is covered by impervious surfaces, such as roofs, streets, drives, and parking lots. The degree of development of this area is therefore the one single factor that affects the runoff coefficient the most. It is impossible to estimate the runoff coefficient with a high degree of accuracy unless an intensive study of the effects on the runoff of the above-mentioned factors have been made. Since, for the subject area, such a study is nonexistent, the runoff coefficients used were based on ranges of values recommended for similar areas, combined with personal judgment based on special knowledge of the subject area and experience.

The following values for runoff coefficient were used as a basis of design. The area between Chelton Road and Palmer Park (approximately 50 acres) $C = 0.35$. The entire remaining area ($990 \pm$ acres) $C = 0.50$. A weighted means of these factors is applied to every point for which runoff is computed.

(2) The intensity of a rainstorm depicts the peak rate of rainfall in inches per hour. This peak varies from storm to storm. Statistically, therefore, the intensity for any frequency storm, as used for design purposes, is the average peak rate found for a number of studied rainstorms.

If a certain intensity rainfall is applied to an impervious surface over a long period of time, neglecting evaporation and transpiration, the rate of runoff would eventually become the same as the rate of rainfall. However, in general a rainstorm starts out at a small rate, it then increases with time until it reaches a peak rate, after which the rate decreases again with respect to time. The corresponding peak rate of runoff is what the storm sewer needs to be sized for in order to prevent flooding. This peak runoff is similar to a floodwave in character. As it travels downstream, assuming no tributaries to it, the floodwave tends to spread out in length and the peak decreases in magnitude with respect to time. Thus, in the real flooding event, as the peak runoff travels downstream, the intensity decreases regardless of contributaries. This phenomenon, that the intensity decreases with time, is incorporated in the Intensity-Duration-Frequency Curves used for the design as seen from the graph in figure I in the appendix.

(3) The Area A used in the rational formula is the actual accumulated area in acres contributing runoff to the point at which the runoff is computed.

D. Storm Sewer Capacities:

The capacities of any and all storm sewers analysed in this study were found using the most widely recognized and used Manning's Formula. This formula is as follows:

$$Q = VA = \frac{1.486}{n} A R^{2/3} S^{1/2}$$ where

Q = Maximum discharge of conduit in CFS
V = Velocity of flow
A = Area of flow in conduit in Sq. Ft.
n = Roughness coefficient of conduit lining
R = Hydraulic radius $= \frac{\text{area}}{\text{wetted perimeter}}$ in FT
S = Slope of conduit in FT/FT

The following values of "n" have been used for this design:

Concrete pipe	0.013
Corrugated metal pipe	0.021
Concrete lined channel	0.015
Unimproved (dirt) channel	0.028

It is to be noted that when sizing a closed conduit, circular, elliptical,arch, or box, inlet and outlet conditions affect the capacity of the conduit. Furthermore because of gradient characteristics of the water and the geometrics of the conduit, the storm sewer will never flow full unless a static pressure head of a magnitude which virtually never exists in practice is applied to it. Thus any closed storm sewer conduit has an optimum practical capacity regardless of what slope the pipe is laid on. This optimum slope is called the critical slope, and the corresponding maximum capacity of the conduit is called critical flow. Figure III in the appendix gives a table of common pipe sizes, their critical slopes for various values of "n", the critical flow, and the corresponding velocity. This table is reproduced from a computer output sheet obtained from a program which used Manning's equation and the critical slope criteria mentioned above. It was used for the purpose of sizing the storm sewer pipes in this study.

DISCUSSION

As we all know, the prediction of weather is a rather uncertain undertaking. Likewise, it is uncertain to predict the runoff from any rainstorm regardless of how it is classified, as briefly discussed under the previous heading, DESIGN CRITERIA. It is, however, known from experience that the Rational Method of computing runoff in general tends to decrease in accuracy with increasing areas of over 100 acres, more or less. A number of other factors affect the degree of accuracy that can be expected from this method for large areas. Therefore, most textbooks in hydrology warn to use this method with caution for areas larger than 100 acres and never to use it for areas in excess of 1200 acres.

The Palmer Park drainage basin studied for this report comprises some 1000 acres, so consequently caution in the use of the Rational Method has been exercised. Let it be mentioned, however, that the basin has two outfall points, each with a separate system of storm sewers leading to it. One outfall point is the existing 63" x 98" elliptical RCP crossing Union Boulevard, and the other is the proposed 6' x 3.5' box crossing Union Boulevard. The first outfall point serves roughly 350 contributory acres, while the second outfall point serves roughly 650 acres.

In order to establish some idea of the degree of accuracy obtained from the Rational Method, another method of computation was used as a check for the second outfall point serving some 650 acres. The method used for this check is commonly called the Modified Hydrograph Method; it was developed by the Soil Conservation Service and modified by the Bureau of Reclamation of the U.S. Department of the Interior. This method is the most widely used for areas in excess of 20 acres and is commonly regarded to give runoff values that more closely match actual runoff than does the Rational Method for the same area. Thus, in the check made for this report, the Modified Hydrograph Method yielded somewhat lower runoff, although the deviation was only about 5%.

The proposed Master Plans enclosed with this report show the location and sizes of the proposed storm sewers along with the suggested phasing of construction. They do not show what type of pipe is preferred, although an indication for this is given in the cost

estimates. This preference of pipe type, reinforced concrete pipe or corrugated metal pipe, is based entirely on hydrologic considerations. As mentioned in subsection "B 2" under section, DESIGN CRITERIA, the intensity (or peak) of runoff decreases with respect to travel time of the peak. If the travel time (or time of concentration " t") could be increased therefore, the runoff rate would decrease and smaller pipes would result down stream. One way of increasing "t" is to reduce the velocity of flow. As discussed in subsection "D" under section DESIGN CRITERIA, any pipe's capacity is reached once the slope is increased to or beyond the critical slope. If the slope is steeper than critical, all that happens is that the depth of flow in the pipe decreases, and the velocity of flow increases (Q = VA). Therefore, for slopes steeper than critical it is advantageous to use pipes with a high resistance to flow (high "n" in Manning's equation). This is the criteria used to determine the preference of pipe indicated in the cost estimates.

The open rectangular asphalt lined channel between North Circle Drive and Alpine Drive produces a retention effect (increased time of concentration) as described above at least to a certain degree. If the flow in that channel (50 cfs expected from the 5 year design storm) was carried in a closed conduit, the velocity of flow in the pipe would be higher than the velocity in the channel. Thus the peak flow rate down stream would be higher. Since no damage to adjacent properties will occur from over flow in that channel and no inconvenience to motorists or pedestrians is anticipated and since it represents a saving in cost, it appears advantageous to leave the open channel as it exists.

The principle discussed above applies also to retention reservoirs, although their advantages are easier to conceptualize. A retention reservoir is a reservoir that has the capacity to fill up during peak flow, while the out flow from it remains within certain lower limits or can be controlled to a certain rate.

One such retention reservoir is located roughly 100 feet downstream from the concrete lined rectangular channel west of Union Boulevard as shown on the master plan. A very rough descriptive analysis of this reservoir is included following:

The reservoir is triangular shaped with the main tributary channel comming from the East (from the Palmer Park drainage basin) and the dam located to the West. It has an emergency open channel spillway located at the South end of the dam. This spillway is roughly 40 feet wide and 2 feet deep. Two 48" corrugated metal pipes, one with a manually operated gate, are located near the bottom of the reservoir through the dam. The capacity of the reservoir up to the spillway level is estimated at 12 acre ft. With 2 feet depth of flow over the spillway the reservoir is estimated to hold approximately 18 acre ft. and the out flow is estimated at approximately 600 cfs through the 2-48" pipes and the spillway combined.

Assuming that it is desirable to keep the maximum rate of out flow at or below 600 cfs due to downstream effects, our rough analysis indicated that the retention reservoir would be adequate for a 25 year ±, 1 hr. rainstorm with a maximum estimated inflow of some 1,500 cfs. For this 25 year rainstorm the rate of inflow would be declining before the retention reservoir is filled to the 18 acre ft. capacity (with 2 ft. depth of flow in spillway).

Any rainstorm more severe than a 25 year ±, 1 hr. rainstorm, however, appears to produce a runoff which is too severe for the reservoir to have any substantial reduction effect on the maximum or peak rate of runoff.

Even if it is assumed that the rate of runoff from the reservoir could be as high as 1,500 cfs more or less, it was found that the reservoir is inadequate for a maximum probable storm and it appears that it would be inadequate for a 50 year 1 hour rainstorm as well. The reason for this is that the two 48" pipes located near the bottom of the reservoir are too small to slow down the filling of the reservoir long enough for the rate of runoff to be on the decline. Or, another way of looking at the problem, the reservoir is too small to accept the volume that reaches it prior to peak rate of runoff.

It must be realized that the measurements and calculations made for this analysis were of a rough approximating character. Therefore a more comprehensive study should be made of both the reservoir and the maximum acceptable runoff in Shooks Run downstream from it. Thus another reservoir not considered in this analysis is located a few hundred feet downstream form the above mentioned one.

It will be noticed by an investigation of the proposed master plan and cost estimates herein that Phase I for Case I and Case II are the same. The reason for this is that it is considered imperative

that the proposed 90" storm sewer be installed as early as possible in order to provide relief for the most troubled flooding area in Mt. Vernon Street. If this is done in Phase I combined with an improvement of the existing inlet structure into the existing 72" CMP south of the railroad track at Howard Avenue, two objectives will be accomplished in the first phase of construction.

First, the majority of the runoff water presently jumping the above mentioned inlet structure will be intersected and thereby a flooding relief will be experienced immediately in the area southwest of that inlet structure. That same floodwater presently jumping the inlet eventually accumulates in Mt. Vernon Street in the area between McArthur Avenue and Tweed Street combined with the runoff from the area east and south of Mt. Vernon Street. Therefore, with an improved inlet into the existing 72" CMP the entire area described above will be relieved of flooding to a certain degree.

Second, by constructing the 90" storm sewer and tieing it in to the existing 72" CMP in the intersection of Le Laray Street and McArthur Avenue, in Phase I, the existing 72" storm sewer downstream from this tie-in point will be made capable of handling the runoff from the tributary storm sewers in Phase II and subsequent phases.

It will be noticed from an inspection of the enclosed cost estimate sheets for Phase I that the estimated costs are somewhat higher than the budgeted money for this phase. Should, however, the lowest construction bid be lower than anticipated or additional funds become available, the possibility of further construction in Phase I would be present. As seen from the cost estimates, for an additional cost of roughly $15,400 a 48" x 78" elliptical RCP with catch basins could be installed in McArthur Avenue from Mt. Vernon Street to the existing 72" CMP. This could relieve some 75 to 90 cfs of runoff from Mt. Vernon Street and would be the next logical priority of construction in terms of accomplishing relief from detrimental flooding.

Currently there are some 13 acres of undeveloped land between LeLaray Street, Prairie Road, La Salle Street and Arlan's parking lot. It is expected that the majority of the rainfall falling on this area will be retained therein prior to development of the area. At the present time it is not known how this area will be developed. For these reasons, no curb inlets are proposed for the 90" storm sewer in Le Laray Street, although it may be found necessary to install them after the area is developed.

The proposed box culvert underneath Union Boulevard is shown on the plans to be 6 ft. wide and 3.5 feet high. With this size the box is estimated capable of handling some 650 cfs, while

the estimated peak runoff from the design storm is estimated to be only approximately 400 cfs. The added cost for oversizing this box (from the design storm) is considered minor, while the increased capacity is substantial, allowing the runoff from a more severe rainstorm (25 year ± 1 hr. storm) to cross Union Boulevard through the box with no flooding of Union Boulevard.

A small portion of the Palmer Park drainage basin was not restudied for this report as mentioned under the heading GENERAL. The storm sewers for these roughly 145 acres as shown in the original report by Henningsen, Durham and Richardson, appears to be well planned and should be installed as shown , except for a few manholes, the 15" pipe proposed in Palmer Park Boulevard between Bellaire Street and Union Boulevard and the 18" pipe proposed in Constitution Avenue between Monteagle Street and Condor Street. For easier convenience these storm sewers are reproduced on the master plan with the minor alterations mentioned above, and their cost estimates are also included.

CONCLUSIONS AND RECOMMENDATIONS:

All conclusive results from the drainage study and analysis of the Palmer Park Drainage basin are presented on the enclosed four proposed master plans and the subsequent cost estimate sheets. Thus the master plans show the locations and sizes of the proposed drainage facilities along with their recommended phases of construction. The cost estimate sheets show the estimated cost of construction, engineering design, surveying and inspection along with the recommended type of storm sewer pipes (RCP or CMP) for each phase. It is to be noted, that unless otherwise shown, the curb inlets will be the City of Colorado Springs standard 4 ft. curb inlet. In a few locations 6 ft. curb inlets are proposed, and they are marked on the master plans with a "6" next to them. Two different sized drop inlets are proposed. The smaller size, generally located in alley entrances to a street will be 9' long and 9" wide, more or less, while the larger size, located in streets will be 15' long and 9" wide, more or less, as indicated on the cost estimate sheets. These sizes, however, are tentative and will be properly sized during the final engineering design stage. The configuration of feeder pipes from the proposed catch basins and their tie in points to the main storm sewers are left out on the master plans and will therefore also have to be determined during the final engineering design stage.

COST ESTIMATES

The subsequent pages outline the estimated costs of construction, engineering design, surveying, and inspection for each phase of construction. Four sets of cost estimates are included, one for each proposed master plan.

All pipe prices in the cost estimates are based on estimated current costs for excavation, placing, backfilling, and compaction, replacement of base courses and asphalt paving, as well as pipe prices for Class II or III reinforced concrete pipes (RCP). If corrugated metal pipes (CMP) should be used for any stretch of storm sewers, the prices are expected to be slightly lower than reflected in the cost estimates herein.

As mentioned in the section called DISCUSSION, the slope of the particular stretch of pipe in question is one major criterion for the determination of the type of pipe (CMP or RCP). Although RCP was used as a basis for unit price, the cost estimates frequently reflect a priority of using CMP based on the above mentioned criteria. Thus, if the cost estimate under DESCRIPTION reads, for example, 36" CMP or RCP, this reflects the preference of a CMP being used rather than an RCP. If it reads 36" CMP (or RCP)I the preference of using CMP is even more certain based on the above mentioned criteria.

For each proposed phase of construction an estimated subtotal of construction costs is given in terms of the 1972 value of the dollar. A factor is then applied to this subtotal estimated to compensate for the inflation between 1972 and the time of construction and the engineering design, surveying and inspection fee added on top of that to give estimated total cost for each phase. It is hoped that any necessary cost adjustments due to change in phasing of any stretch of storm sewer will be thereby simplified.

Except in a few cases, existing utilities have not been located. Unexpected difficulties and cost related to utility relocation have therefore been omitted from the cost estimates.

CASE I PHASE I 1972 ALTERNATIVE I

AVAILABLE MONEY APPROXIMATELY $285,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Union Blvd.	Remove 2-42"x60"CMP	110	LF	16	1,760
Union Blvd.	Construct 6'x3'-6"box culvert	50	CY	85	4,250
Union Blvd.	Backfill, compaction, paving , traffic control & contingencies	1	LS	1000	1,000
Arlan's Parking lot	90" RCP	760	LF	94	71,440
Le Laray	90" RCP	1900	LF	94	178,600
	MH's	3	Ea	300	900
	Rework RR inlet	1	LS	2000	2,000
	Total Construction Cost				259,950
	Engineering design, construction & survey fee 8.95%				23,266
	Engineering drainage report & study				3,000
	TOTAL ESTIMATED COST PHASE I *				286,216

*NOTE: It is imperative that all the above construction is included in Phase I. For additional relief of flooding in Mt.Vernon St. it is recommended that the 48" x 76" elliptical RCP in McArthur St. is completed in the same Phase (I) as reflected in the cost estimate below:

McArthur	48"x76" elliptical RCP	200	LF	50	10,000
	**6'curb inlets with 21" feeders	4	Ea	770	3,080
	4' curb inlets with 18" feeders	2	Ea	650	1,300
	Total Estimated Construction Cost Above Included				274,330
	Engineering design, construction & survey fee @ 8.846%				24,267
	Drainage report cost				3,000
	TOTAL ESTIMATED COST PHASE I				301,597

** NOTE: 4' in lieu of 6' if not included in Phase I

CASE I PHASE II 1973 ALTERNATIVE I

AVAILABLE MONEY APPROXIMATELY $150,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
McArthur	48"x76" elliptical RCP (if not in Phase I)	200	LF	50	10,000
McArthur	27"RCP	330	LF	15.50	5,115
Mt. Vernon	60" RCP	565	LF	41	23,165
Howard	54" RCP	330	LF	35	11,550
Howard	48" RCP	305	LF	29	8,845
Palmer Pk	48" RCP	330	LF	29	9,570
Caramillo	30" RCP	640	LF	16.90	10,816
Caramillo	27" RCP	310	LF	15.50	4,805
	4' curb inlets with 18" feeders	20	Ea	650	13,000
	6' curb inlets with 21" feeder stub	2	Ea	690	1,380
	drop inlet (9'x9"±) with 21" feeder	1	Ea	1480	1,480
	MH's	7	Ea	300	2,100
Eagle View	34"x53" elliptical RCP	180	LF	28	5,040
Eagle View	42" RCP	620	LF	23	14,260
Palmer Pk	42" RCP	100	LF	23	2,300
	4' curb inlets with 18" feeders	7	Ea	650	4,550
	MH's	2	Ea	300	600
Subtotal (1972 prices) Estimated Construction Cost					128,576
Subtotal 5% controlled inflation included					135,005
Engineering design, construction & survey fee @ 10.1734%					13,735
TOTAL ESTIMATED COST PHASE II					148,740

CASE I PHASE III 1974 ALTERNATIVE I

AVAILABLE MONEY APPROXIMATELY $100,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Le Laray	66" RCP (CMP O.K.)	635	LF	48	30,480
Howard	36" RCP	735	LF	20	14,700
Le Laray	66" RCP (CMP O.K.)	700	LF	48	33,600
	MH's	2	Ea	300	600
Subtotal (1972 prices) Estimated Construction Cost					79,380
Subtotal 1972-1973 inflation included (1.05x79,380)					83,349
Total estimated construction cost 1974 price 7.5%1973/1974 inflation included					89,600
Engineering design, construction & survey fee @ 10.91%					9,775
TOTAL ESTIMATED COST PHASE III					99,375

CASE I PHASE IV 1975 ALTERNATIVE I

AVAILABLE MONEY APPROXIMATELY $100,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Le Laray	66" RCP (CMP O.K.)	1,255	LF	48	60,240
Le Laray	Rework existing siphon invert	1	Ea	160	160
Le Laray	24" feeder pipe	20	LF	14.30	286
Alpine	60" RCP	190	LF	41	7,790
Alpine	6' curb inlet with 21" feeder	1	Ea	770	770
Alpine	4' curb inlet with 18" feeder	1	Ea	650	650
N. Circle	24" RCP	170	LF	14.30	2,431
	4' curb inlets with 18" feeder	3	Ea	650	1,950
	MH's	3	Ea	300	900
Subtotal (1972 prices) Estimated Construction Cost					75,177
Subtotal 1972-1974 inflation included (1.12875x74,957)					84,856
Total estimated construction cost 1975 price(6.5% inflation included)					90,372
Engineering desing, construction & survey fee @ 10.8885%					9,840
TOTAL ESTIMATED COST PHASE IV					100,212

CASE I PHASE V 1976 ALTERNATIVE I

AVAILABLE MONEY APPROXIMATELY $200,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Alpine	60" RCP	875	LF	41	35,875
La Salle	42" RCP	900	LF	23	20,700
La Salle	Rework & tie to existing siphon	1	LS	160	160
	4' curb inlets with 18" feeder	8	Ea	650	5,200
	MH's	2	Ea	300	600
Constit.	60" RCP	800	LF	41	32,800
Constit.	Rework existing drop inlet	1	LS	170	170
Constit.	54" RCP	515	LF	35	18,025
	4' curb inlets with 18" feeder	9	Ea	650	5,850
	MH	1	Ea	300	300
Tweed	42" RCP	70	LF	23	1,610
Tweed	36" RCP	650	LF	20	13,000
Palmer Pk	33" RCP	130	LF	18.40	2,392
	4' curb inlets with 18" feeders	8	Ea	650	5,200
	Drop inlet(9'x9"±) with 21" feeder	1	Ea	1480	1,480
	MH	1	Ea	300	300
Subtotal (1972 prices) Estimated Construction Cost					143,662
Subtotal 1972-1975 inflation included (1.20212x143,662)					172,699
Total Estimated Construction cost 1976 price (6.5% inflation included)					183,924
Engineering design, construction & survey fee @ 9.5913%					17,641
TOTAL ESTIMATED COST PHASE V					201,565

CASE I PHASE VI 1977 ALTERNATIVE I

AVAILABLE MONEY APPROXIMATELY $200,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
N. Circle	54" CMP (or RCP)	1,190	LF	35	41,650
Brady	33" RCP	50	LF	18.40	920
Brady	30" RCP	250	LF	16.90	4,225
N. Circle	48" CMP (or RCP)	910	LF	29	26,390
Maizeland	36" RCP	230	LF	20	4,600
	4' curb inlets with 18" feeders	9	Ea	650	5,850
	drop inlet(15'x9"±)	1	Ea	1600	1,600
	MH's	2	Ea	300	600
Constit.	48" RCP	255	LF	29	7,395
Carlton	36" CMP (or RCP)	825	LF	20	16,500
Brady	36" RCP	300	LF	20	6,000
Brady	30" RCP	240	LF	16.90	4,056
Brady	24" RCP	320	LF	14.30	4,576
	4' curb inlets with 18" feeders	14	Ea	650	9,100
	MH's	3	Ea	300	900
Subtotal (1972 prices) Construction Cost					134,362
Subtotal 1972-1976 inflation included (1.280256x134,362)					172,017
Total estimated construction cost 1977 price (6.5% inflation included)					183,198
Engineering design, construction & sruvey fee @ 9.600%					17,587
TOTAL ESTIMATED COST PHASE VI					200,785

CASE I PHASE VII 1978 ALTERNATIVE I

AVAILABLE MONEY APPROXIMATELY $200,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Maizeland	33" RCP	1,515	LF	18.40	27,876
Maizeland	30" RCP or CMP	650	LF	16.90	10,985
Maizeland	27" CMP (or RCP)	350	LF	15.50	5,425
Chelton	24" CMP (or RCP)	50	LF	14.30	715
	4' curb inlets with 18" feeders	5	Ea	650	3,250
	drop inlet (15'x9"±)	1	Ea	1,600	1,600
	MH's	4	Ea	300	1,200
N. Circle	36" CMP or RCP	450	LF	20	9,000
Sturgis	33" CMP (or RCP)	235	LF	18.40	4,324
	4' curb inlets with 18" feeders	4	Ea	650	2,600
	MH	2	Ea	300	600
Glen Summer	42" CMP (or RCP)	930	LF	23	21,390
Patrician	24" RCP	320	LF	14.30	4,576
Patrician	21" RCP	640	LF	13.50	8,640
Clarcson	21" RCP	150	LF	13.50	2,025
	4' curb inlets with 18" feeders	14	Ea	650	9,100
	drop inlet (9'x9"±) with 21" feeder	1	Ea	1,480	1,480
	MH's	4	Ea	300	1,200
Palmer Pk	42" CMP (or RCP)	320	LF	23	7,360
	4' curb inlets with 18" feeders	3	Ea	650	1,950
	MH	1	Ea	300	300
Subtotal (1972 prices) Construction Cost					125,596
Subtotal 1972-1977 inflation included (1.36347x125,596)					171,246
Total estimated construction cost 1978 prices (6.5% inflation included)					182,377
Engineering design construction & survey fee @ 9.61%					17,526
TOTAL ESTIMATED COST PHASE VII CASE I ALTERNATIVE I					199,903

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CASE I PHASE VIII 1979 ALTERNATIVE I

AVAILABLE MONEY APPROXIMATELY $200,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Palmer Pk	42" RCP	280	LF	23	6,440
Monteagle	36" CMP (or RCP)	340	LF	20	6,800
Alley	36" CMP or RCP	295	LF	20	5,900
Alexander	33" RCP	335	LF	18.40	6,164
Monteagle	27" RCP	335	LF	15.50	5,193
McArthur	24" CMP (or RCP)	290	LF	14.30	4,147
	4' curb inlets with 18" feeders	11	Ea	650	7,150
	drop inlet (9'x9"±)	1	Ea	1200	1,200
	MH's	3	Ea	300	900
La Salle	36" RCP	300	LF	20	6,000
La Salle	33" RCP	290	LF	18.40	5,336
La Salle	27" RCP	290	LF	15.50	4,495
La Salle	24" RCP	320	LF	14.30	4,576
	4' curb inlets with 18" feeders	10	Ea	650	6,500
	MH's	2	Ea	300	600
Palmer Pk	30" RCP	690	LF	16.90	11,661
Palmer Pk	27" CMP (or RCP)	230	LF	15.50	3,565
Palmer Pk	24" CMP (or RCP)	450	LF	14.30	6,435
Northview	24" CMP (or RCP)	770	LF	14.30	11,011
	4' curb inlets with 18" feeders	8	Ea	650	5,200
	MH's	3	Ea	300	900
	Subtotal (1972 prices) Construction Cost				110,173
	Subtotal 1972-1978 inflation included (1.452099x118,170)				159,982
	Total estimated construction cost 1979 prices (6.5% inflation included)				170,381
	Engineering design, construction & survey fee @ 9.7525%				16,616
	TOTAL ESTIMATED COST PHASE VIII CASE I ALTERNATIVE I				186,997

CASE I PHASE IX 1980 ALTERNATIVE I

AVAILABLE MONEY APPROXIMATELY OPEN

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
N. Circle & Constit.	RCP-150' long with reworked inlet	1	LS	4,500	4,500
Palmer Pk	27" RCP	310	LF	15.50	4,805
Palmer Pk	21" RCP	290	LF	13.50	3,915
	4' curb inlets with 18" feeders	4	Ea	650	2,600
	MH	1	Ea	300	300
Constit.	33" RCP	485	LF	18.50	8,924
Constit.	30" RCP	270	LF	16.90	4,563
Constit.	27" RCP	290	LF	15.50	4,495
Constit.	24" RCP	280	LF	14.30	4,004
	4' curb inlets with 18" feeders	10	Ea	650	6,500
	MH	2	Ea	300	600
San Luis	30" CMP or RCP	230	LF	16.90	3,887
San Luis	27" CMP (or RCP)	340	LF	15.50	5,270
San Carlos	21" CMP (or RCP)	530	LF	13.50	7,155
San Carlos to Chelton	21" CMP (or RCP)	430	LF	13.50	5,805
Chelton	21" CMP or RCP	450	LF	13.50	6,075
	4' curb inlets with 18" feeders	5	Ea	650	3,250
	4' curb inlets with 18" feeders	3	Ea	650	1,860
	MH's	4	Ea	300	1,200
Chelton	24" CMP (or RCP)	200	LF	14.30	2,860
Chelton	21" CMP (or RCP)	750	LF	13.50	10,125
Chelton	curb & gutter(asph. match)	4700	LF	3.00	14,100
	4' curb inlets with 18" feeders	4	Ea	620	2,480
	MH's	2	Ea	300	600

continued

Continued

CASE I PHASE IX 1980 ALTERNATIVE I

AVAILABLE MONEY APPROXIMATELY OPEN

Location	Description of Item	Quantity	Unit	Unit Price	Amount
Brady	27" RCP	340	LF	15.50	5,270
Brady	24" CMP or RCP	300	LF	14.30	4,290
Brady	4' curb inlets with 18" feeders	6	Ea	650	3,900
	MH's	2	Ea	300	600
N. Circle	42"x155'± RCP or CMP with headwalls	1	LS	5700	5,700
Bedford	21" CMP or RCP	450	LF	13.50	6,075
	4' curb inlets	2	Ea	650	1,300
	MH	1	Ea	300	300

Subtotal (1972 prices) Estimated Construction Cost	137,308
Subtotal 1972-1979 inflation included (1.546485 x 137,308)	212,345
TOTAL Estimated Construction Cost 1980 prices (6.5% inflation included)	226,147
Engineering Design, Construction & Survey Fee @ 9.204%	20,815
TOTAL ESTIMATED COST PHASE IX CASE I ALT I	246,962

The plans reveal a proposed 21" and 24" storm drain in Constitution between McArthur Street and Wasson High School. The justification for such a storm drain is debatable. On one hand, the street is capable of handling any runoff in that area without any damage to private property. Furthermore, it is an existing curb inlet and 24" storm drain at the low spot of Constitution capable of draining the water across Constitution into the rectangular concrete channel crossing underneath the railroad.

On the other hand, the area is used for loading and unloading of high school students, and futhermore, a storm drain would improve the flow of traffic during heavy rainfall.

Following is a cost estimate for the storm drain in case it should be decided to install the pipes:

Location	Description	Quantity	Unit	Unit Price	Amount
Constit.	24" Crossing RCP or CMP	50	LF	14.30	715
Constit.	24" RCP or CMP	420	LF	14.30	6,006
Constit.	21" RCP or CMP	320	LF	13.50	4,320
	4' curb inlet with 18" feeders	4	Ea	650	2,600
	MH's	1	Ea	300	300
Subtotal (1972 prices) Estimated Construction Cost					13,941
Total Estimated Construction Cost 1981 Price (estimated inflation included) Engineering Fee Additional					24,453

In case of the possibility that it should be decided to carry the water in a closed conduit presently flowing in an open unimproved ditch in the alley between Le Laray Street, a 78" CMP or RCP would be needed. The costs for this enterprise is estimated below:

Location	Description	No. of Units	Unit	Unit Price	Price
Alley	78" RCP or CMP	730	LF	56	40,880
Tweed	42" RCP or CMP in 4'x4' " " channel	116	LF	18	2,088
Tweed	Drop inlet & headwalls	1	LS	2,600	2,600
Subtotal Estimated (1972 prices) construction cost					45,568
Subtotal Estimated Construction Cost 1980 prices (1.64701x45,568)					75,051
Total Estimated Construction Cost 1981 price (6.5% inflation included)					79,930
Engineering design, construction & survey fee @ 11.21%					8,960
TOTAL ESTIMATED COST 1981					88,890

CASE I LOCATION	LAST PHASE DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Constit.	42" RCP	100	LF	23.00	2,300
Oriole	36" CMP (or RCP)	700	LF	20.00	14,000
Oriole	33" RCP or CMP	600	LF	18.40	11,040
Oriole	27" RCP or CMP	320	LF	15.50	4,960
Oriole	21" RCP or CMP	280	LF	13.50	3,780
Constit.	27" RCP or CMP	300	LF	15.50	4,650
	24" RCP or CMP	720	LF	14.30	10,296
	21" RCP or CMP	420	LF	13.50	5,670
	4' curb inlets with 18" feeders	32	Ea	650	20,800
	MH's	7	Ea	300	2,100
Union	30"RCP	430	LF	16.90	7,267
	27" RCP	460	LF	15.50	7,130
	4' curb inlets with 18" feeders	6	Ea	650	3,900
	6' curb inlets with 21" feeders	2	Ea	770	1,540
	MH's	2	Ea	300	600
Subtotal (1972 prices) Estimated Construction Cost					100,033
Total Estimated Construction Cost (Estimated inflation included 1.754066x100,033) 1981 Price					175,464

Engineering design, construction & survey fee additional

CASE I PHASE I 1972 ALTERNATIVE II

AVAILABLE MONEY APPROXIMATELY $285,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Union Blvd.	Remove 2-42"x60" CMP	110	LF	16	1,760
Union Blvd.	Construct 6'x3'-6" Box Culvert	50	CY	85	4,250
Union Blvd.	Backfill, compaction, paving, traffic control & contingencies	1	LS	1,000	1,000
Union Blvd.	90" RCP	300	LF	94	28,200
Le Laray	90" RCP	2,610	LF	94	245,340
Le Laray	MH's	4	Ea	300	1,200
Le Laray	Rework RR Inlet	1	LS	2,000	2,000
	Total Construction Cost				283,750
	Engineering design, construction & survey fee 8.772%				24,890
	Engineering drainage report & study				3,000
	TOTAL ESTIMATED COST PHASE I*				311,640

*NOTE: It is imperative that all the above construction is included in Phase I.

For additional relief of flooding in Mt. Vernon St. it is recommended that the 48" x 76" elliptical RCP in McArthur be completed in the same Phase (I)as reflected in the cost estimate below:

McArthur	48"x76" elliptical RCP	200	LF	50	10,000
McArthur & Mt. Vernon	** 6' curb inlets with 21" feeders	4	Ea	770	3,080
	4' curb inlets with 18" feeders	2	Ea	650	1,300
	Total Estimated Construction Cost Above Included				298,130
	Engineering design, construction & survey fee @ 8.66%				25,818
	Drainage Report cost				3,000
	TOTAL ESTIMATED COST PHASE I				326,948

** NOTE: 4' in lieu of 6' if not included in Phase I

CASE I PHASE II 1973 ALTERNATIVE II

AVAILABLE MONEY APPROXIMATELY $150,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
McArthur	48"x76" elliptical RCP (if not in Phase I)	200	LF	50	10,000
McArthur	27" RCP	330	LF	15.50	5,115
Mt. Vernon	60" RCP	565	LF	41	23,165
Howard	54" RCP	330	LF	35	11,550
Howard	48" RCP	305	LF	29	8,845
Palmer Pk	48" RCP	330	LF	29	9,570
Caramillo	30" RCP	640	LF	16.90	10,816
Caramillo	27" RCP	310	LF	15.50	4,805
	4' curb inlets with 18" feeders	20	Ea	650	13,000
	6' curb inlets with 21" feeder	2	Ea	690	1,380
	drop inlet (9'x9"+) with 21" feeder	1	Ea	1,480	1,480
	MH's	7	Ea	300	2,100
Eagle View	34"x53" elliptical RCP	180	LF	28	5,040
Eagle View	42" RCP	620	LF	23	14,260
Palmer Pk	42" RCP	100	LF	23	2,300
	4' curb inlets with 18" feeders	7	Ea	650	4,550
	MH's	2	Ea	300	600
Subtotal (1972 prices) Estimated Construction Cost					128,576
Subtotal 5% controlled inflation included					135,005
Engineering design, construction & sruvey fee @ 10.1734%					13,735
TOTAL ESTIMATED COST PHASE II					148,740

CASE I PHASE III 1974 ALTERNATIVE II

AVAILABLE MONEY APPROXIMATELY $100,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Le Laray	66" RCP (or CMP)	635	LF	48	30,480
Howard	36" RCP	735	LF	20	14,700
Le Laray	66" RCP (or CMP)	700	LF	48	33,600
	MH's	2	Ea	300	600
	Subtotal (1972 prices) Estimated Construction Cost				79,380
	Subtotal 1972-1973 inflation included (1x05x79,380)				83,349
	Total Estimated Construction Cost 1974 price 7.5% 1973/1974 inflation included				89,600
	Engineering design, construction & survey fee @ 10.91%				9,775
	TOTAL ESTIMATED COST PHASE III				99,375

CASE I PHASE IV 1975 ALTERNATIVE II

AVAILABLE MONEY APPROXIMATELY $100,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Le Laray	66" RCP (or CMP)	1,255	LF	48	60,240
Le Laray	Rework existing siphon invert	1	Ea	160	160
Le Laray	24" feeder pipe	20	LF	14.30	286
Alpine	60" RCP	190	LF	41	7,790
Alpine	6' curb inlet with 21" feeder	1	Ea	770	770
Alpine	4' curb inlet with 18" feeder	1	Ea	650	650
N. Circle	24" RCP	170	LF	14.30	2,431
	4' curb inlets with 18" feeder	3	Ea	650	1,950
	MH's	3	Ea	300	900
	Subtotal (1972 prices) Estimated Construction Cost				75,177
	Subtotal 1972-1974 inflation included (1.12875x74,957)				84,856
	Total estimated construction cost 1975 price (6.5% inflation included)				90,372
	Engineering design, construction & survey fee @ 10.8885%				9,840
	TOTAL ESTIMATED COST PHASE IV				100,212

(40)

CASE I PHASE V 1976 ALTERNATIVE II

AVAILABLE MONEY APPROXIMATELY $200,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Alpine	60" RCP	875	LF	41	35,875
La Salle	42" RCP	900	LF	23	20,700
La Salle	Rework & tie to existing siphon	1	LS	160	160
	4' curb inlets with 18" feeder	8	Ea	650	5,200
	MH's	2	Ea	300	600
Constit.	60" RCP	800	LF	41	32,800
Constit.	Rework existing drop inlet	1	LS	170	170
Constit.	54" RCP	515	LF	35	18,025
	4' curb inlets with 18" feeder	9	Ea	650	5,850
	MH	1	Ea	300	300
Tweed	42" RCP	70	LF	23	1,610
Tweed	36" RCP	650	LF	20	13,000
Palmer Pk	33" RCP	130	LF	18.40	2,392
	4' curb inlets with 18" feeders	8	Ea	650	5,200
	drop inlet (9'x9"±) with 21" feeder	1	Ea	1480	1,480
	MH	1	Ea	300	300
Subtotal (1972 prices) Estimated Construction Cost					143,662
Subtotal 1972-1975 inflation included (1.20212x143,662)					172,699
Total Estimated construction cost 1976 price (6.5% inflation included)					183,924
Engineering design, construction & survey fee @ 9.5913%					17,641
TOTAL ESTIMATED COST PHASE V					201,565

CASE I PHASE VI 1977 ALTERNATIVE II

AVAILABLE MONEY APPROXIMATELY $200,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
N. Circle	54" CMP (or RCP)	1,190	LF	35	41,650
Brady	33" RCP	50	LF	18	920
Brady	30" RCP	250	LF	16.90	4,225
N. Circle	48" CMP (or RCP)	910	LF	29	26,390
Maizeland	42" RCP	200	LF	23	4,600
	4' curb inlets with 18" feeders	9	Ea	650	5,850
	drop inlet (15'x9"±)	1	Ea	1600	1,600
	MH's	2	Ea	300	600
Constit.	48" RCP	255	LF	29	7,395
Carlton	36" CMP (or RCP)	825	LF	20	16,500
Brady	36" RCP	300	LF	20	6,000
Brady	30" RCP	240	LF	16.90	4,056
Brady	24" RCP	320	LF	14.30	4,576
	4' curb inlets with 18" feeders	14	Ea	650	9,100
	MH's	3	Ea	300	900
Subtotal (1972 prices) Estimated Construction Cost					134,362
Subtotal 1972-'976 inflation included (1.280256x134,362)					172,017
Total Estimated construction cost 1977 price (6.5% inflation included)					183,198
Engineering design, construction & survey fee @ 9.600%					17,587
TOTAL ESTIMATED COST PHASE VI					200,785

CASE I PHASE VII 1978 ALTERNATIVE II

AVAILABLE MONEY APPROXIMATELY $200,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Maizeland	36" RCP	1,545	LF	20	30,900
Maizeland	33" RCP or CMP	1,000	LF	18.40	18,400
Chelton	30" CMP (or RCP)	50	LF	18.90	845
	4' curb inlets with 18" feeders	5	Ea	650	3,250
	drop inlet(15'x9"±)	1	Ea	1600	1,600
	MH's	4	Ea	300	1,200
N.Circle	30" CMP or RCP	450	LF	16.90	7,605
	4' curb inlets with 18" feeders	2	Ea	650	1,300
	MH	1	Ea	300	300
Glen Summer	42" CMP (or RCP)	930	LF	23	21,390
Patrician	24" RCP	320	LF	14.30	4,576
Patrician	21" RCP	640	LF	13.50	8,640
Clarcson	21" RCP	150	LF	13.50	2,025
	4' curb inlets with 18" feeders	14	Ea	650	9,100
	drop inlet (9'x9"±) with 21" feeder	1	Ea	1480	1,480
	MH's	4	Ea	300	1,200
Palmer Pk	42" CMP (or RCP)	320	LF	23	7,360
	4' curb inlets with 18" feeders	3	Ea	650	1,950
	MH	1	Ea	300	300
Subtotal (1792 prices) Construction Cost					123,421
Subtotal 1972-1977 inflation included (1.36347x123,421)					168,281
Total Estimated construction cost 1978 prices (6.5% inflation included)					179,219
Engineering design, construction & survey fee @ 9.6473%					17,290
TOTAL ESTIMATED COST PHASE VII					196,509

CASE I PHASE VIII 1979 ALTERNATIVE II

AVAILABLE MONEY APPROXIMATELY $200,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Palmer Pk	42" RCP	280	LF	23	6,440
Monteagle	36" CMP (or RCP)	340	LF	20	6,800
Alley	36" CMP or RCP	295	LF	20	5,900
Alexander	33" RCP	335	LF	18.40	6,164
Monteagle	27" RCP	335	LF	15.50	5,193
McArthur	24" CMP (or RCP)	290	LF	14.30	4,147
	4' curb inlets with 18" feeders	11	Ea	650	7,150
	drop inlet (9'x9"±)	1	Ea	1200	1,200
	MH's	3	Ea	300	900
La Salle	36" RCP	300	LF	20	6,000
La Salle	33" RCP	290	LF	18.40	5,336
La Salle	27" RCP	290	LF	15.50	4,495
La Salle	24" RCP	320	LF	14.30	4,576
	4' curb inlets with 18" feeders	10	Ea	650	6,500
	MH's	2	Ea	300	600
Palmer Pk	30" RPC	690	LF	16.90	11,661
Palmer Pk	27" CMP (or RCP)	230	LF	15.50	3,565
Palmer Pk	24" CMP (or RCP)	450	LF	14.30	6,435
Northview	24" CMP (or RCP)	770	LF	14.30	11,011
	4' curb inlets with 18" feeders	8	Ea	650	5,200
	MH's	3	Ea	300	900
Subtotal (1972 prices) Construction Cost					110,173
Subtotal 1972-1978 inflation included (1.452099x118,170)					159,982
Total estimated construction cost 1979 prices (6.5% inflation included)					170,381
Engineering design, construction & survey fee @ 9.7525%					16,616
TOTAL ESTIMATED COST PHASE VII CASE I ALTERNATIVE II					186,997

CASE I PHASE IX 1980 ALTERNATIVE II

AVAILABLE MONEY APPROXIMATELY OPEN

LOCATION D	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
N. Circle &	42" RCP-150'long with				
Constit.	reworked inlet	1	LS	4,500	4,500
Palmer Pk	27" RCP	310	LF	15.50	4,805
Palmer Pk	21" RCP	290	LF	13.50	3,915
	4' curb inlets with 18" feeders	4	Ea	650	2,600
	MH	1	Ea	300	300
Constit.	33" RCP	485	LF	18.40	8,924
Constit.	30" RCP	270	LF	16.90	4,563
Constit.	27" RCP	290	LF	15.50	4,495
Constit.	24" RCP	280	LF	14.30	4,004
	4' curb inlets with 18" feeders	10	Ea	650	6,500
	MH	2	Ea	300	600
Sturgis	30" CMP or RCP	235	LF	16.90	3,972
San Luis	21" CMP or RCP	570	LF	13.50	7,695
	4' curb inlets with 18" feeders	8	Ea	650	5,200
	Mh's	2	Ea	300	600
Chelton	30" CMP (or RCP)	200	LF	16.90	3,380
Chelton	27" CMP (or RCP)	600	LF	15.50	9,300
Chelton	24" CMP (or RCP)	200	LF	14.30	2,860
Chelton	21" RCP	900	LF	13.50	12,150
Chelton	18" RCP	450	LF	13.00	5,850
Chelton	curb & gutter(asph.match)	4700	LF	3.00	14,100
	4' curb inlets with 18" feeders	7	Ea	620	4,340
	MH's	4	Ea	300	1,200
N. Circle	42" x155' RCP or CMP with headwalls	1	LS	5700	5,700

continued

Continued

CASE I PHASE IX 1980 ALTERNATIVE II

AVAILABLE MONEY APPROXIMATELY OPEN

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Brady	27" RCP	340	LF	15.50	5,270
Brady	24" CMP (or RCP)	300	LF	14.30	4,290
	4' curb inlets with 18" feeders	6	Ea	650	3,900
	MH's	2	Ea	300	600
Bedford	21" CMP (or RCP)	450	LF	13.50	6,075
	4' curb inlets with 18" feeders	2	Ea	650	1,300
	MH	1	Ea	300	300
Subtotal (1972 prices) Estimated Construction Cost					143,288
Subtotal 1972-1979 inflation included (1.5464851x143,288)					221,593
Total estimated construction cost 1980 prices (6.5% inflation included)					235,996
Engineering design, construction & survey fee @ 9.1300%					21,546
TOTAL ESTIMATED COST PHASE IX CASE I ALTERNATIVE II					257,542

The plans reveal a proposed 21" and 24" storm drain in Constitution between McArthur Street and Wasson High School. The justification for such a storm drain is debatable. On one hand, the street is capable of handling any runoff in that area without any damage to private property. Furthermore, it is an existing curb inlet and 24" storm drain at the low spot of Constitution capable of draining the water across Constitution into the rectangular concrete channel crossing underneath the railroad.

On the other hand, the area is used for loading and unloading of high school students, and furthermore, a storm drain would improve the flow of traffic during heavy rainfall. Following is a cost estimate for the storm drain in case it should be decided to install the pipes:

Location	Description	No. of Units	Unit	Unit Price	Price
Constit.	24" Crossing RCP or CMP	50	LF	14.30	715
Constit.	24" RCP or CMP	420	LF	14.30	6,006
Constit.	21" RCP or CMP	320	LF	13.50	4,320
	4' curb inlet with 18" feeders	4	Ea	650	2,600
	MH's	1	Ea	300	300
Subtotal (1972 prices) Estimated Construction Cost					13,941
Total Estimated Construction Cost 1981 price (estimated inflation included)					24,453
Engineering Fee Additional					

In case of the possibility that, it should be decided to carry the water in a closed conduit, presently flowing in an open unimproved ditch in the alley between Le Laray Street and Mt. Vernon Street, a 78" CMP or RCP would be needed. The costs for this enterprise is estimated below:

Location	Description of Item	No. of Units	Unit	Unit Price	Amount
Alley	78" RCP or CMP	730	LF	56	40,880
Tweed	42" RCP or CMP in 4' x4' 42" RCP channel	116	LF	18	2,088
Tweed	drop inlet & headwalls	1	LS	2,600	2,600
	Subtotal Estimated (1972 Prices) Construction Cost				45,568
	Subtotal Estimated construction cost 1980 prices(1.64701x45,568)				75,051
	Total Estimated Construction Cost 1981 price(6.5% inflation included)				79,930
	Engineering design, construction & survey fee @ 11.21%				8,960
	TOTAL ESTIMATED COST (1981)				88,890

CASE I LOCATION	LAST PHASE DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Constit.	42" RCP	100	LF	23.00	2,300
Oriole	36" CMP (or RCP)	700	LF	20.00	14,000
Oriole	33" RCP or CMP	600	LF	18.40	11,040
Oriole	27" RCP or CMP	320	LF	15.50	4,960
Oriole	21" RCP or CMP	280	LF	13.50	3,780
Constit.	27" RCP or CMP	300	LF	15.50	4,650
	24" RCP or CMP	720	LF	14.30	10,296
	21" RCP or CMP	420	LF	13.50	5,670
	4' curb inlets with 18" feeders	32	Ea	650	20,800
	MH's	7	Ea	300	2,100
Union	30"RCP	430	LF	16.90	7,267
	27" RCP	460	LF	15.50	7,130
	4' curb inlets with 18" feeders	6	Ea	650	3,900
	6' curb inlets with 21" feeders	2	Ea	770	1,540
	MH's	2	Ea	300	600
Subtotal (1972 prices) Estimated Construction Cost					100,033
Total Estimated Construction Cost (Estimated inflation included 1.754066x100,033) 1981 Price					175,464

Engineering design, construction & survey fee additional

CASE II PHASE I 1972 ALTERNATIVE I
AVAILABLE MONEY APPROXIMATELY $285,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Union Blvd.	Remove 2-42"x60"CMP	110	LF	16	1,760
Union Blvd.	Construct 6'x3'-6" Box Culvert	50	CY	85	4,250
Union Blvd.	Backfill, compaction, paving, traffic control & contingencies	1	LS	1,000	1,000
Union Blvd.	90" RCP	330	LF	94	28,200
Le Laray	90" RCP	2,610	LF	94	245,340
Le Laray	MH's	4	Ea	300	1,200
Le Laray	Rework RR Inlet	1	LS	2,000	2,000
	Total Construction Cost				283,750
	Engineering design, construction & survey fee 8.772%				24,890
	Engineering drainage report & study				3,000
	TOTAL ESTIMATED COST PHASE I *				311,640

*NOTE: It is imperative that all the above construction is included in Phase I. For additional relief of flooding in Mt. Vernon St. it is recommended that the 48" x 76" elliptical RCP in McArthur be completed in the same Phase (I) as reflected in the cost estimate below:

McArthur	48"x76" elliptical RCP	200	LF	50	10,000
McArthur & Mt. Vernon	**6' curb inlets with 21" feeders	4	Ea	770	3,080
	4' curb inlets with 18" feeders	2	Ea	650	1,300
	Total Estimated Construction Cost Above Included				298,130
	Engineering design, construction & survey fee @ 8.66%				25,818
	Drainage Report Cost				3,000
	TOTAL ESTIMATED COST PHASE I				326,948

**NOTE: 4' in lieu of 6' if not included in Phase I

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CASE II PHASE II 1973 ALTERNATIVE I

AVAILABLE MONEY APPROXIMATELY $300,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Le Laray	66" RCP or CMP	635	LF	48	30,480
Howard	36" RCP	735	LF	20	14,700
Le Laray	66" RCP or CMP	1,955	LF	48	93,840
Le Laray	Rework existing siphon invert	1	Ea	160	160
Le Laray	24" Feeder pipe	20	LF	14.30	286
Alpine	60" RCP	280	LF	41	11,480
Alpine	6' curb inlet with 21"	1	Ea	770	770
N. Circle	24" RCP	170	LF	14.30	2,431
	4' curb inlets with 18" feeder	4	Ea	650	2,600
	MH's	5	Ea	300	1,500
McArthur	48"x76" elliptical RCP (if not in Phase I)	200	LF	50	10,000
Mt. Vernon	60" RCP	505	LF	41	23,165
Howard	54" RCP	330	LF	35	11,550
Caramillo	30" RCP	640	LF	16.90	10,816
Caramillo	27" RCP	310	LF	15.50	4,805
McArthur	27" RCP	330	LF	15.50	5,115
	4' curb inlets with 18" feeders	16	Ea	650	10,400
	6' curb inlets with 21" feeders	2	Ea	690	1,380
	MH's	6	Ea	300	600
Eagle View	34"x53"elliptical RCP	180	LF	28	5,040
Eagle View	42" RCP	620	LF	23	14,260

continued

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CASE II PHASE II 1973 ALTERNATIVE I

AVAILABLE MONEY APPROXIMATELY $300,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Palmer PK	42" RCP	100	LF	23	2,300
	4' curb inlets with 18" feeders	7	Ea	650	4,550
	MH's	2	Ea	300	600
Subtotal (1972 prices) Estimated Construction Cost					262,828
Total Estimated Construction Cost 5% controlled inflation included					275,969
Engineering Design, construction & survey fee @ 8.8302%					24,369
TOTAL ESTIMATED CONSTRUCTION COST PHASE II CASE II ALTERNATIVE I					300,338

CASE II PHASE III 1974 ALTERNATIVE I

AVAILABLE MONEY APPROXIMATELY $200,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Alpine	60" RCP	785	LF	41	32,185
Alpine	Rework MH & tie to existing siphon	1	LS	160	160
La Salle	42" RCP	900	LF	23	20,700
La Salle	4' curb inlets with 18" feeders	8	Ea	650	5,200
	MH's	2	Ea	300	600
Constit.	60" RCP	800	LF	41	32,800
Constit.	54" RCP	515	LF	35	18,025
	Rework exist.drop inlet	1	LS	170	170
	4' curb inlets with 18" feeders	9	Ea	650	5,850
	MH's	1	Ea	300	300
Howard	48" RCP	305	LF	29	8,845
Palmer Pk	48" RCP	330	LF	29	9,570
Palmer Pk	42" CMP (or RCP)	320	LF	23	7,360
	4' curb inlets with 18" feeders	7	Ea	650	4,550
	Drop inlet (9'x9"±) with 21" feeder	1	Ea	1480	1,480
	MH's	2	Ea	300	600
Northview	24" CMP (or RCP)	770	LF	14.30	11,011
	4' curb inlets with 18" feeders	3	Ea	650	1,950
	MH's	1	Ea	300	300
	Subtotal (1972 prices) Estimated Construction Cost				161,656
	Subtotal 1972-1973 inflation included				169,739
	Total estimated construction cost 1974 prices (7.5% inflation included)				182,469
	Engineering design, construction & survey fee @ 9.6086%				17,533
	TOTAL ESTIMATED CONSTRUCTION COST PHASE III CASE I ALTERNATIVE I				200,002

CASE II PHASE IV 1975 ALTERNATIVE I

AVAILABLE MONEY APPROXIMATELY $200,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
N. Circle	54" CMP (or RCP)	1,190	LF	35	41,650
N. Circle	48" CMP (or RCP)	910	LF	29	26,390
Brady	33" RCP	50	LF	18.40	920
Maizeland*	36" RCP	220	LF	20	4,400
	4' curb inlets with 18" feeders	6	Ea	650	3,900
	Drop inlet (15'x9"±)	1	Ea	1,600	1,600
	MH's	2	Ea	300	600
Constit.	48" RCP	255	LF	29	7,395
Carlton	36" CMP (or RCP)	825	LF	20	16,500
Brady	36" RCP	300	LF	20	6,000
Brady	30" RCP	240	LF	16.90	4,056
Brady	24" RCP	320	LF	14.30	4,576
	4' curb inlets with 18" feeders	14	Ea	650	9,100
	MH's	3	Ea	300	900
Tweed	42" RCP	70	LF	23	1,610
Tweed	36" RCP	650	LF	20	13,000
Palmer Pk	33" RCP	130	LF	18.40	2,392
	4' curb inlets with 18" feeders	8	Ea	650	5,200
	drop inlet (9'x9''±) with 21" feeders	1	Ea	1,480	1,480
	MH	1	Ea	300	300
	Subtotal (1972 prices) Estimated Construction Cost				151,969
	Subtotal including inflation 1972-1974 (1.12875x151,969)				171,535
	Total estimated construction cost 1975 price (6.5% inflation included)				182,685
	Engineering design, construction & survey fee @ 9.6061%				17,549
	TOTAL ESTIMATED COST PHASE IV CASE II ALTERNATIVE I				200,234

* The length of this 36" pipe and the corresponding location of the drop MH can be varied within 200' with no subsequent effect on the overall drainage.

CASE II PHASE V 1976 ALTERNATIVE I

AVAILABLE MONEY APPROXIMATELY $400,000

Location	Description of Item	Quantity	Unit	Unit Price	Amount
Glen Summer	42" CMP (or RCP)	930	LF	23	21,390
Patrician Way	24" RCP	320	LF	14.30	4,576
Patrician Way	21" RCP	640	LF	13.50	8,640
Clarcson	21" RCP	150	LF	13.50	2,025
	4' curb inlet w/18" feeders	14	Ea	650	9,100
	Drop inlet (9'x9"±) with 21" feeders	1	Ea	1480	1,480
	MH's	4	Ea	300	1,200
Palmer Pk	42" RCP	280	LF	23	6,440
Monteagle	36" CMP (or RCP)	340	LF	20	6,800
Alley	36" CMP or RCP	295	LF	20	5,900
Alexander	33" RCP	335	LF	18.40	6,164
Monteagle	27" RCP	335	LF	15.50	5,193
McArthur	24" CMP (or RCP)	290	LF	14.30	4,147
	4' curb inlets w/18" feeders	11	Ea	650	7,150
	Drop inlet (9'x9"±)	1	Ea	1200	1,200
	MH's	3	Ea	300	900
N. Circle @ Constit.	42" RCP-150' long with reworked inlet	1	LS	4500	4,500
N. Circle	36" CMP or RCP	450	LF	20	9,000
Sturgis	33" CMP (or RCP)	235	LF	18.40	4,324
San Luis	30" CMP or RCP	230	LF	16.90	3,887
San Luis	27" CMP or RCP	340	LF	15.50	5,270
	4' curb inlets w/18" feeders	9	Ea	650	5,850
	MH's	3	Ea	300	900
Maizeland	33" RCP	1525	LF	18.40	28,060
Maizeland	30" RCP or CMP	650	LF	16.90	10,985
Maizeland	27" CMP (or RCP)	350	LF	15.50	5,425
Chelton	24" CMP (or RCP)	50	LF	14.30	715
Bedford	21" CMP (or RCP)	450	LF	13.50	6,075

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CASE II PHASE V 1976 ALTERNATIVE I

AVAILABLE MONEY APPROXIMATELY $400,000

Location	Description of Item	Quantity	Unit	Unit Price	Amount
Bedford	4' curb inlets w/18" feeders	7	Ea	650	4,550
	Drop inlets (15'x9"±)	1	Ea	1600	1,600
	MH's	5	Ea	300	1,500
Brady	30" RCP	250	LF	16.90	4,225
Brady	27" RCP	340	LF	15.50	5,270
Brady	24" CMP (or RCP)	300	LF	14.30	4,290
	4' curb inlets w/18" feeders	9	Ea	650	5,850
	MH's	2	Ea	300	600
LaSalle	36" RCP	300	LF	20	6,000
LaSalle	33" RCP	290	LF	18.40	5,336
LaSalle	27" RCP	290	LF	15.50	4,495
LaSalle	24" RCP	320	LF	14.30	4,576
	4' curb inlets w/18" feeders	10	Ea	650	6,500
	MH's	2	Ea	300	600
Constit.	33" RCP	485	LF	18.40	8,924
Constit.	30" RCP	270	LF	16.90	4,563
Constit.	27" RCP	290	LF	15.50	4,495
Constit.	24" RCP	280	LF	14.30	4,004
	4' curb inlets w/18" feeders	10	Ea	650	6,500
	MH's	2	Ea	300	600
Palmer Pk	30" RCP	690	LF	16.90	11,661
Palmer Pk	27" CMP (or RCP)	230	LF	15.50	3,565
Palmer Pk	24" CMP (or RCP)	450	LF	14.30	6,435
	4' curb inlets w/18" feeders	5	Ea	650	3,250
	MH's	2	Ea	300	600

Continued

Continued:

CASE II PHASE V 1976 ALTERNATIVE I

AVAILABLE MONEY APPROXIMATELY $400,000

Location	Description of Item	Quantity	Unit	Unit Price	Amount
	Subtotal (1972 prices) Estimated Construction Cost				286,685
	Subtotal 1972-1975 inflation included (1.20211875 x 286,685)				344,629
	TOTAL Estimated Construction Cost 1976 price (6.5% inflation included)				367,030
	Engineering Design, Construction & Survey Fee @ 8.3148%				30,518
	TOTAL ESTIMATED COST PHASE V CASE II ALT I				397,548

CASE II PHASE VI 1977 ALTERNATIVE I

AVAILABLE MONEY APPROXIMATELY $400,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
N. Circle	47"x155'+ RCP or CMP w/headwalls	1	LS	5,700	5,700
Palmer Pk	27" RCP	310	LF	15.50	4,805
Palmer Pk	21" RCP	290	LF	13.50	3,915
	4' curb inlets w/18" feeders	4	Ea	650	2,600
	MH	1	Ea	300	300
Chelton	24" CMP (or RCP)	200	LF	14.30	3,860
Chelton	21" CMP (or RCP)	750	LF	13.50	10,125
	4' Curb inlets w/18" feeders	4	Ea	620	2,480
	MH	2	Ea	300	600
San Carlos	21" CMP (or RCP)	530	LF	13.50	7,155
San Carlos	21" CMP (or RCP)	430	LF	13.50	5,805
Chelton	21" CMP (or RCP)	450	LF	13.50	6,075
	4' curb inlets w/18" feeders	3	Ea	620	1,860
	MH's	3	Ea	300	900
Chelton	curb & gutter(asph.match)	4,700	LF	3.00	14,100
Subtotal (1972 prices) Estimated Construction Cost					69,280
Subtotal 1972-1976 Inflation included (1.2802565x69,280)					88,696
Total Estimated Construction Cost 1977 price (6.5% inflation included)					94,461
Engineering Design, Construction & survey fee @ 10.7617%					10,166
TOTAL ESTIMATED COST*					104,627

* See Next Page

The plans reveal a proposed 21" and 24" storm drain in Constitution between McArthur Street and Wasson High School. The justification for such a storm drain is debatable. On one hand, the street is capable of handling any runoff in that area without any damage to private property. Furthermore, it is an existing curb inlet and 24" storm drain at the low spot of Constitution capable of draining the water across Constitution into the rectangular concrete channel crossing underneath the railroad.

On the other hand, the area is used for loading and unloading of high school students, and furthermore, a storm drain would improve the flow of traffic during heavy rainfall.

Following is a cost estimate for the storm drain in case it should be decided to install the pipes:

Location	Description	Quantity	Unit	Unit Price	Amount
Constit.	24" Crossing RCP or CMP	50	LF	14.30	715
Constit.	24" RCP or CMP	420	LF	14.30	6,006
Constit.	21" RCP or CMP	320	LF	13.50	4,320
	4' curb inlet with 18" feeders	4	Ea	650	2,600
	MH's	1	Ea	300	300
	Subtotal (1972 prices) Estimated Construction Cost				13,941
	Total Estimated Construction Cost 1977 price (Estimated inflation included - 1.363473139 x 13,941)				19,008
	Engineering Fee Additional.				

In case of the possibility that it should be decided to carry the water in a closed conduit presently flowing in an open unimproved ditch in the alley between LeLaray Street, a 78" CMP or RCP would be needed. The costs for this enterprise is estimated below:

Location	Description	Quantity	Unit	Unit Price	Amount
Alley	78" RCP or CMP	730	LF	56	40,880
Tweed	42" RCP or CMP in 4'x4' " " channel	116	LF	18	2,088
Tweed	Drop inlet & headwalls	1	LS	2600	2,600
	Subtotal Estimated (1972 prices) Construction Cost				45,568
	Total Estimated Construction Cost 1977 price, (estimated inflation included) 1.3634731 x 45,568				62,131

Engineering Design, Construction & Survey fee additional.

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CASE II LAST PHASE

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Constit.	42" RCP	100	LF	23.00	2,300
Oriole	36" CMP (or RCP)	700	LF	20.00	14,000
Oriole	33" RCP or CMP	600	LF	18.40	11,040
Oriole	27" RCP or CMP	320	LF	15.50	4,960
Oriole	21" RCP or CMP	280	LF	13.50	3,780
Constit.	27" RCP or CMP	300	LF	15.50	4,650
	24" RCP or CMP	720	LF	14.30	10,296
	21" RCP or CMP	420	LF	13.50	5,670
	4' curb inlets with 18" feeders	32	Ea	650	20,800
	MH's	7	Ea	300	2,100
Union	30" RCP	430	LF	16.90	7,267
	27" RCP	460	LF	15.50	7,130
	4' curb inlets with 18" feeders	6	Ea	650	3,900
	6' curb inlets with 18" feeders	2	Ea	770	1,540
	MH's	2	Ea	300	600
	Total Estimated Construction Cost 1977 Price(estimated inflation included- 1.36347x100,033)				136,392

Engineering design, construction & survey fee additional

CASE II PHASE I 1972 ALTERNATIVE II
AVAILABLE MONEY APPROXIMATELY $285,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Union Blvd.	Remove 2-42"x60"CMP	110	LF	16	1,760
Union Blvd.	Construct 6'x3'-6" Box Culvert	50	CY	85	4,250
Union Blvd.	Backfill, compaction, paving, traffic control & contingencies	1	LS	1,000	1,000
Union Blvd.	90" RCP	330	LF	94	28,200
Le Laray	90" RCP	2,610	LF	94	245,340
Le Laray	MH's	4	Ea	300	1,200
Le Laray	Rework RR Inlet	1	LS	2,000	2,000
	Total Construction Cost				283,750
	Engineering design, construction & survey fee 8.772%				24,890
	Engineering drainage report & study				3,000
	TOTAL ESTIMATED COST PHASE I *				311,640

*NOTE: It is imperative that all the above construction is included in Phase I.

For additional relief of flooding in Mt. Vernon St. it is recommended that the 48" x 76" elliptical RCP in McArthur be completed in the same Phase (I) as reflected in the cost estimate below:

McArthur	48"x76" elliptical RCP	200	LF	50	10,000
McArthur & Mt.Vernon	**6' curb inlets with 21" feeders	4	Ea	770	3,080
	4' curb inlets with 18" feeders	2	Ea	650	1,300
	Total Estimated Construction Cost Above Included				298,130
	Engineering design, construction & survey fee @ 8.66%				25,818
	Drainage Report Cost				3,000
	TOTAL ESTIMATED COST PHASE I				326,948

**NOTE: 4' in lieu of 6' if not included in Phase I

CASE II PHASE II 1973 ALTERNATIVE II

AVAILABLE MONEY APPROXIMATELY $300,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Le Laray	66" RCP or CMP	635	LF	48	30,480
Howard	36" RCP	735	LF	20	14,700
Le Laray	66" RCP or CMP	1,955	LF	48	93,840
Le Laray	Rework existing siphon invert	1	Ea	160	160
Le Laray	24" feeder pipe	20	LF	14.30	286
Alpine	60" RCP	280	LF	41	11,480
Alpine	6' curb inlet with 21" feeder	1	Ea	770	770
N. Circle	24" RCP	170	LF	14.30	2,431
	4' curb inlets with 18" feeder	4	Ea	650	2,600
	MH's	5	Ea	300	1,500
McArthur	48"x76" elliptical RCP (if not in Phase I)	200	LF	50	10,000
Mt. Vernon	60" RCP	505	LF	41	23,165
Howard	54" RCP	330	LF	35	11,550
Caramillo	30" RCP	640	LF	16.90	10,816
Caramillo	27" RCP	310	LF	15.50	4,805
McArthur	27" RCP	330	LF	15.50	5,115
	4' curb inlets with 18" feeders	16	Ea	650	10,400
	6' curb inlets with 21" feeders	2	Ea	690	1,380
	MH's	6	Ea	300	600
Eagle View	34"x53"elliptical RCP	180	LF	28	5,040
Eagle View	42" RCP	620	LF	23	14,260
Palmer Pk	42" RCP	100	LF	23	2,300
	4' curb inlets with 18" feeders	7	Ea	650	4,550
	MH's	2	Ea	300	600

Continued

Continued

CASE II PHASE II 1973 ALTERNATIVE II

Subtotal (1972 prices) Estimated Construction Cost	262,828
Total Estimated Construction Cost 5% controlled inflation included	275,969
Engineering Design, construction & Survey Fee @ 8.8302%	24,369
TOTAL ESTIMATED CONSTRUCTION COST PHASE II CASE II ALT II	300,338

CASE II PHASE III 1974 ALTERNATIVE II

AVAILABLE MONEY APPROXIMATELY $200,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Alpine	60" RCP	785	LF	41	32,185
Alpine	Rework MH & tie to exist. siphon	1	LS	160	160
La Salle	42"	900	LF	23	20,700
	4' curb inlets with 18" feeders	8	Ea	650	5,200
	MH's	2	Ea	300	600
Constit.	60" RCP	800	LF	41	32,800
Constit.	54" RCP	505	LF	35	18,025
	Rework exist. drop inlet	1	LS	170	170
	4' curb inlets with 18" feeders	9	Ea	650	5,850
	MH's	1	Ea	300	300
Howard	48" RCP	305	LF	29	8,845
Palmer Pk	48" RCP	330	LF	29	9,570
Palmer Pk	42" CMP or RCP	320	LF	23	7,360
	4' curb inlets with 18" feeders	7	Ea	650	4,550
	Drop inlet(9'x9"±) with 21" feeder	1	Ea	1480	1,480
	MH's	2	Ea	300	600
Northview	24" CMP or RCP	770	LF	14.30	11,011
	4' curb inlets with 18" feeders	3	Ea	650	1,950
	MH's	1	Ea	300	300
	Subtotal (1972 prices) Estimated Construction Cost				161,656
	Subtotal 1972-1973 inflation included				169,739
	Total estimated construction cost 1974 prices (7.5% inflation included)				182,469
	Engineering design, construction & survey fee @ 9.6086%				17,533
	TOTAL ESTIMATED CONSTRUCTION COST PHASE III CASE I ALT II				200,002

CASE II PHASE IV 1975 ALTERNATIVE II

AVAILABLE MONEY APPROXIMATELY $200,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
N. Circle	54" CMP or RCP	1,190	LF	35	41,650
Brady	33" RCP	50	LF	18.40	920
N. Circle	48" CMP or RCP	910	LF	29	26,390
Maizeland*	42" RCP	190	LF	23	4,400
	4' curb inlets with 18" feeders	6	Ea	650	3,900
	drop inlet (15'x9"±)	1	Ea	1600	1,600
	MH's	2	Ea	300	600
Constit.	48" RCP	255	LF	29	7,395
Carlton	36" CMP or RCP	825	LF	20	16,500
Brady	36" RCP	300	LF	20	6,000
Brady	30" RCP	240	LF	16.90	4,056
Brady	24" RCP	320	LF	14.30	4,576
	4' curb inlets with 18" feeders	14	Ea	650	9,100
	MH's	3	Ea	300	900
Tweed	42" RCP	70	LF	23	1,610
Tweed	36" RCP	650	LF	20	13,000
Palmer Pk	33" RCP	130	LF	18.40	2,392
	4' curb inlets with 18" feeders	8	Ea	650	5,200
	Drop inlet (9'x9"±) with 21" feeder	1	Ea	1480	1,480
	MH	1	Ea	300	300
	Subtotal (1972 prices) Estimated Construction Costs				151,969
	Subtotal including 1972-1974 inflation (1.12875x151,969)				171,535
	Total Estimated Construction cost 1975 price (6.5% inflation included)				182,685
	Engineering design, construction & survey fee @ 9.601%				17,549
	TOTAL ESTIMATED COST PHASE IV CASE II ALT. II				200,234

*The length of this 42" pipe and the corresponding location of the drop MH can be varied within 200' with no subsequent effect on the overall drainage.

CASE II PHASE V 1976 ALTERNATIVE II

AVAILABLE MONEY APPROXIMATELY $400,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Glen Summer	42" CMP (or RCP)	930	LF	23.00	21,390
Patrician Way	24" RCP	320	LF	14.30	4,576
Patrician Way	21" RCP	640	LF	13.50	8,640
Clarcson	21" RCP	150	LF	13.50	2,025
	4' curb inlets w/18" feeders	14	Ea	650	9,100
	drop inlet (9'x9"±)w/21" feeder	1	Ea	1480	1,480
	MH's	4	Ea	300	1,200
Palmer Pk	42" RCP	280	LF	23.00	6,440
Monteagle	36" CMP (or RCP)	340	LF	20.00	6,800
Alley	36" CMP or RCP	295	LF	20.00	5,900
Alexander	33" RCP	335	LF	18.40	6,164
Monteagle	27" RCP	335	LF	15.50	5,193
McArthur	24" CMP (or RCP)	290	LF	14.30	4,147
	4' curb inlets w/18" feeders	11	Ea	650	7,150
	drop inlet (9'x9"±)	1	Ea	1200	1,200
	MH's	3	Ea	300	900
N. Circle @	42" RCP-150' long with				
Constit.	reworked inlet	1	LS	4,500	4,500
Maizeland	36" RCP	1555	LF	20.00	31,100
Maizeland	33" RCP(or CMP)	1000	LF	18.40	18,400
Chelton	30" CMP (or RCP)	50	LF	16.90	845
Bedford	21" CMP (or RCP)	50	LF	16.90	6,075
	4' curb inlets w/18" feeders	7	Ea	650	4,550
	drop inlet (15'x9"±)	1	Ea	1,600	1,600
	MH	5	Ea	300	1,500
N. Circle	30" CMP (or RCP)	450	LF	16.90	7,605
Sturgis	30" CMP or RCP	235	LF	16.90	3,972

continued

Continued

CASE II PHASE V 1976 ALTERNATIVE II

AVAILABLE MONEY APPROXIMATELY $400,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
San Luis	21" RCP	570	LF	13.50	7,695
	4' curb inlests w/18" feeders	9	Ea	650	5,850
	MH's	3	Ea	300	900
Brady	30" RCP	250	LF	16.90	4,225
Brady	27" RCP	340	LF	15.50	5,270
Brady	24" CMP (or RCP)	300	LF	14.30	4,290
	4' curb inlets w/18" feeders	9	Ea	650	5,850
	MH's	2	Ea	300	600
La Salle	36" RCP	300	LF	20.00	6,000
La Salle	33" RCP	290	LF	18.40	5,336
La Salle	27" RCP	290	LF	15.50	4,495
La Salle	24" RCP	320	LF	14.30	4,576
	4' curb inlets w/18" feeders	10	Ea	650	6,500
	MH's	2	Ea	300	600
Constit.	33" RCP	485	LF	18.40	8,924
Constit.	30" RCP	270	LF	16.90	4,563
Constit.	27" RCP	290	LF	15.50	4,495
Constit.	24" RCP	280	LF	14.30	4,004
	4' curb inlets w/18" feeders	10	Ea	650	6,500
	MH's	2	Ea	300	600
Palmer Pk	30" RCP	690	LF	16.90	11,661
Palmer Pk	27" CMP (or RCP)	230	LF	15.50	3,561
Palmer Pk	24" CMP (or RCP)	450	LF	14.30	6,435
	4' curb inlets w/18" feeders	5	Ea	650	3,250

continued

Continued

CASE II PHASE V 1976 ALTERNATIVE II

AVAILABLE MONEY APPROXIMATELY $400,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Palmer Pk	MH's	2	Ea	300	600

Subtotal (1972 prices) Estimated Construction Cost	289,232
Subtotal 1972-1975 inflation included (1.20211875x289,232)	348,052
Total Estimated Construction Cost 1976 Price(6.5% inflation included)	370,675
Engineering Design, construction & survey fee @ 8.2966 %	30,753
TOTAL ESTIMATED COST PHASE V CASE II ALTERNATIVE II	401,428

CASE II PHASE VI 1977 ALTERNATIVE II

AVAILABLE MONEY APPROXIMATELY $400,000

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
N. Circle	42"x155' + RCP or CMP culvert w/headwalls	1	LS	5,700	5,700
Palmer Pk	27" RCP	310	LF	15.50	4,805
Palmer Pk	21" RCP	290	LF	13.50	3,915
	4' curb inlets w/18" feeders	4	Ea	650	2,600
	MH	1	Ea	300	300
Chelton	30" CMP (or RCP)	200	LF	16.90	3,380
Chelton	27" CMP (or RCP)	600	LF	15.50	9,300
Chelton	24" CMP or RCP	200	LF	14.30	2,860
Chelton	21" RCP	900	LF	13.50	12,150
Chelton	18" RCP	450	LF	13.00	5,850
Chelton	curb & gutter(asph. match)	4,700	LF	3.00	14,100
	4' curb inlets w/18" feeders	7	Ea	620	4,340
	MH's	4	Ea	300	1,200
	Subtotal (1972 prices) Estimated Construction Cost				70,500
	Subtotal 1972-1976 inflation included (1.7802565x70,500)				90,258
	Total Estimated Construction Cost 1977 Prices(6.5% inflation included)				96,125
	Engineering design, construction & survey fee @ 10.710%				10,295
	TOTAL ESTIMATED COST*				106,420

* See Next Page

(70)

The plans reveal a proposed 21" and 24" storm drain in Constitution between McArthur Street and Wasson High School. The justification for such a storm drain is debatable. On one hand, the street is capable of handling any runoff in that area without any damage to private property. Furthermore, it is an existing curb inlet and 24" storm drain at the low spot of Constitution capable of draining the water across Constitution into the rectangular concrete channel crossing underneath the railroad.

On the other hand, the area is used for loading and unloading of high school students, and furthermore, a storm drain would improve the flow of traffic during heavy rainfall. Following is a cost estimate for the storm drain in case it should be decided to install the pipes:

Location	Description	No. of Units	Unit	Unit Price	Price
Constit.	24" Crossing RCP or CMP	50	LF	14.30	715
Constit.	24" RCP or CMP	420	LF	14.30	6,006
Constit.	21" RCP or CMP	320	LF	13.50	4,320
	4' curb inlet with 18" feeders	4	Ea	650	2,600
	MH's	1	Ea	300	300

Subtotal (1972 prices) Estimated Construction Cost 13,941

Total Estimated Construction cost 1977 price (inflation included 1.363473139x13,941) 19,008

Engineering Fee Additional

In case of the possibility that it should be decided to carry the water in a closed conduit presently flowing in an open unimproved ditch in the alley between Le Laray Street, a 78" CMP or RCP would be needed. The costs for this enterprise is estimated below:

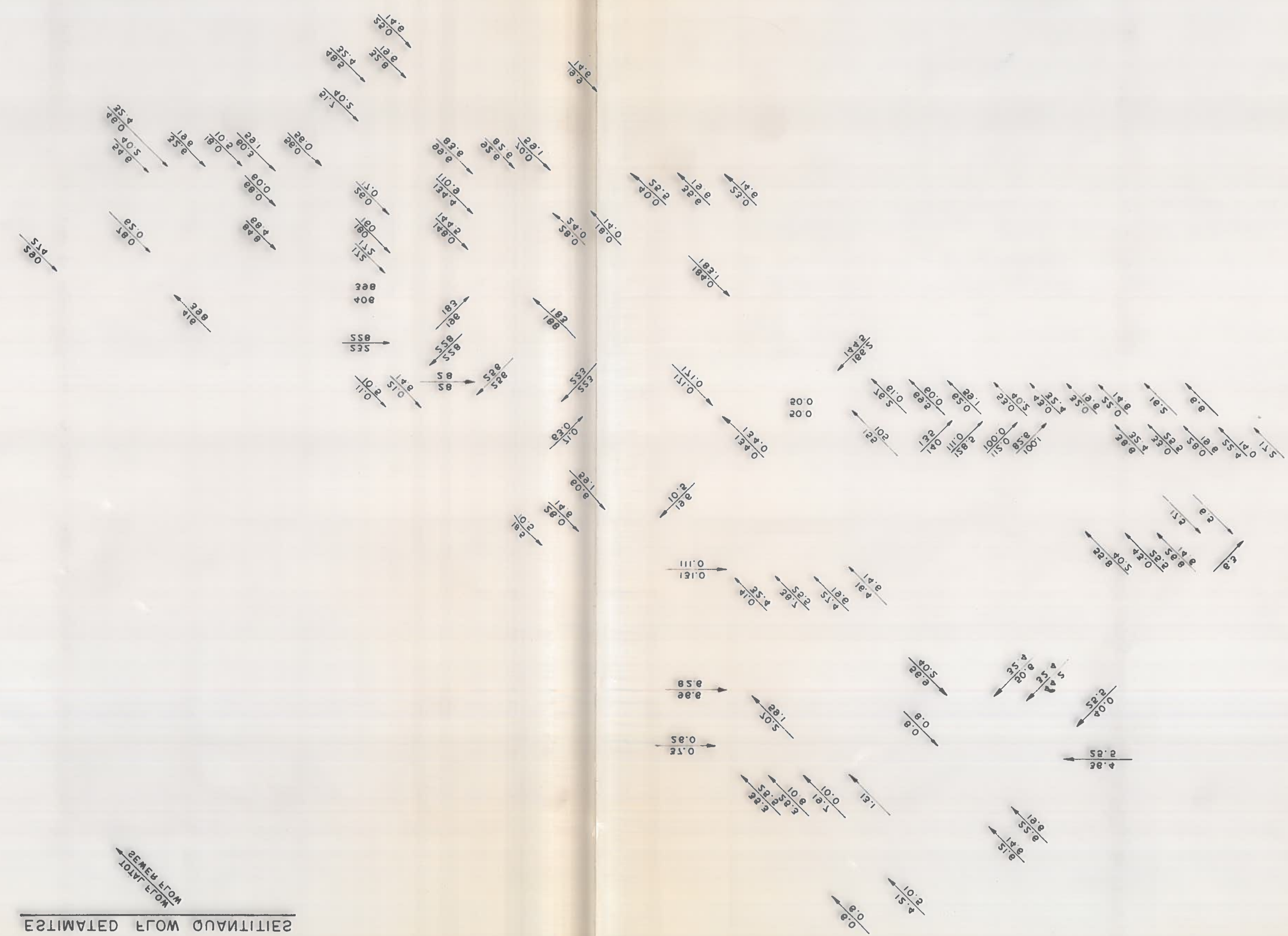
Location	Description	No. of Units	Unit	Unit Price	Amount
Alley	78" RCP or CMP	730	LF	56	40,880
Tweed	42" RCP or CMP in 4'x4' " " channel	116	LF	18	2,088
Tweed	drop inlet & headwalls	1	LS	2600	2,600
	Subtotal Estimated (1972 prices) construction cost				45,568
	TOTAL ESTIMATED CONSTRUCTION COST 1977 Price (estimated inflation included 1.36347x45,568)				62,131

Engineering design, construction & survey fee additional.

CASE II LAST PHASE

LOCATION	DESCRIPTION OF ITEM	NO. OF UNITS	UNIT	UNIT PRICE	AMOUNT
Constit.	42" RCP	100	LF	23.00	2,300
Oriole	36" CMP (or RCP)	700	LF	20.00	14,000
Oriole	33" RCP or CMP	600	LF	18.40	11,040
Oriole	27" RCP or CMP	320	LF	15.50	4,960
Oriole	21" RCP or CMP	280	LF	13.50	3,780
Constit.	27" RCP or CMP	300	LF	15.50	4,650
	24" RCP or CMP	720	LF	14.30	10,296
	21" RCP or CMP	420	LF	13.50	5,670
	4' curb inlets with 18" feeders	32	Ea	650	20,800
	MH's	7	Ea	300	2,100
Union	30" RCP	430	LF	16.90	7,267
	27" RCP	460	LF	15.50	7,130
	4' curb inlets with 18" feeders	6	Ea	650	3,900
	6' curb inlets with 18" feeders	2	Ea	770	1,540
	MH's	2	Ea	300	600
Total Estimated Construction Cost 1977 Price(estimated inflation included- 1.36347x100,033)					136,392

Engineering design, construction & survey fee additional


ESTIMATED FLOW QUANTITIES
TOTAL FLOW
SEWER FLOW

CASE I ALTERNATIVE I

DRAINAGE AREA BOUNDARY

DRAINAGE AREA BOUNDARY

CURB & GUTTER

AREA NOW RESTUDIED IN THIS REPORT

LAST PHASE

WASSON HIGH SCHOOL

JEFFERSON SCHOOL

EAST JUNIOR HIGH SCHOOL

58" x 36" CMP ARCH (2-42" STEEL)

31" x 50" CMP ARCH

42" CMP

OPEN DITCH OPEN CONC. "U" CHANNEL

W/GATE

RETENTION RESERVOIR

DAM

SPILLWAY

6'x3'-6" BOX CULVERT

2-58"x36" CSP ARCH

24" 24" 18" 18" 18"

63" x 98" ELLIPTICAL RCP

CONC. BRIDGE

72" RCP

OPEN "U" OPEN CONC. "U" CHANNEL

ABANDON EXISTING 72" CMP

72" CMP

34"x53" ELLIPTICAL

72" ELLIPTICAL

29"x18" CMP ARCH

24" CMP

REWORK EXIST. 21" INLET

OPEN CONC. "V" CHANNEL

48" CMP

REWORK EXIST. INLET

OPEN ASPHALT "U" CHANNEL

58"x36" CMP ARCH SIPHON

24" CMP SIPHON

10 CURB OUTLETS FROM KING SOOPERS PARKING LOT

DRAINAGE AREA BOUNDARY

N

0 200 400 600 800

graphic scale

LEGEND

LINE WITH: CURB INLET MANHOLE DROP INLET

EXISTING:

PROPOSED:

PHASE I

II

III

IV

V

VI

VII

VIII

IX

STORM SEWER SYSTEM
PALMER PARK AREA

DESIGN PROPOSAL FOR THE CITY OF COLORADO SPRINGS

DESIGNED M.A.

DRAWN W.B.T.

CHECKED

APPROVED

KARCICH & WEBER, INC.

ENGINEERS PLANNERS CONSULTANTS

COLORADO SPRINGS

SCALE	JOB NUMBER	DRAWING NO.

ESTIMATED FLOW QUANTITIES

TOTAL FLOW
SEWER FLOW

CASE I ALTERNATIVE II

DRAINAGE AREA BOUNDARY

DRAINAGE AREA BOUNDARY

CURB & GUTTER

AREA NOT RESTUDIED IN THIS REPORT

AREA NOT RESTUDIED IN THIS REPORT

WASSON HIGH SCHOOL

JEFFERSON SCHOOL

EAST JUNIOR HIGH SCHOOL

58" x 36" CMP ARCH

(2-42" STEEL)

31" x 50" CMP ARCH

42" CMP

OPEN DITCH

OPEN CONC. "U" CHANNEL

W/GATE

RETENTION RESERVOIR

6'x3'-6" BOX CULVERT

2-58" x 36" CSP ARCH

24" 24" 18" 18" 18"

63" x 98" ELLIPTICAL RCP

CONC. BRIDGE

72" RCP

OPEN DITCH

OPEN CONC. "U" CHANNEL

REWORK EXIST. 2' INLET

29" x 18" CMP ARCH

24" CMP

OPEN CONC. "V" CHANNEL

48" CMP

REWORK EXIST. NLET

OPEN ASPHALT "U" CHANNEL

58" x 36" CMP ARCH SIPHON

24" CMP SIPHON

ABANDON EXISTING 72" CMP

72" CMP

10 CURB OUTLETS FROM KING SOOPERS PARKING LOT

DRAINAGE AREA BOUNDARY

N

0 200 400 600 800

graphic scale

LEGEND

LINE WITH:	CURB INLET	MANHOLE	DROP INLET
EXISTING:			
PROPOSED:			
PHASE I			
" II			
" III			
" IV			
" V			
" VI			
" VII			
" VIII			
" IX			

STORM SEWER SYSTEM
PALMER PARK AREA

DESIGN PROPOSAL FOR THE CITY OF COLORADO SPRINGS

DESIGNED	M.A.
DRAWN	W.B.T.
CHECKED	

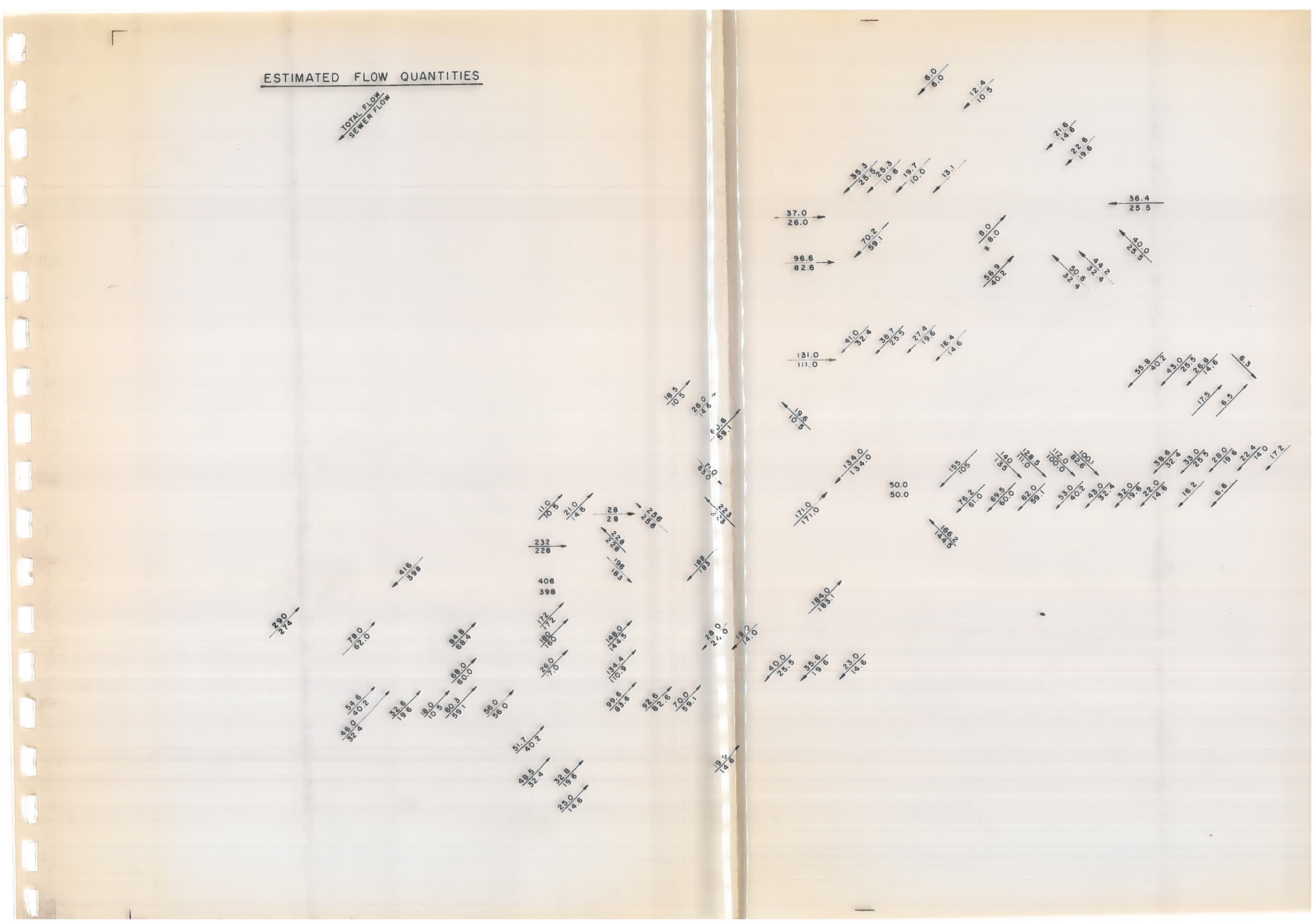
KARCICH & WEBER, INC.
ENGINEERS PLANNERS CONSULTANTS

APPROVED

COLORADO SPRINGS	SCALE	JOB NUMBER	DRAWING NO.

ESTIMATED FLOW QUANTITIES

TOTAL FLOW / SEWER FLOW



CASE II ALTERNATIVE I

DRAINAGE AREA BOUNDARY

DRAINAGE AREA BOUNDARY

CURB & GUTTER

AREA NOT RESTUDIED IN THIS REPORT

58" X 36" CMP ARCH

31" X 50" CMP ARCH

OPEN DITCH

OPEN CONC. "U" CHANNEL

W/GATE

RETENTION RESERVOIR

6'x3'-6" BOX CULVERT

2-58"x36" CSP ARCH

63"x98" ELLIPTICAL RCP

OPTIONAL 78" CONC. BRIDGE

72" RCP

OPEN "U" DITCH

OPEN CONC. "U" CHANNEL

AREA NOT RESTUDIED IN THIS REPORT

ABANDON EXISTING 72" CMP

72" CMP

WASSON HIGH SCHOOL

JEFFERSON SCHOOL

EAST JUNIOR HIGH SCHOOL

29"x18" CMP ARCH

24" CMP

OPTIONAL REWORK EXIST. 21" INLET

OPEN CONC. "V" CHANNEL

48" CMP

REWORK EXIST. INLET

OPEN ASPHALT "U" CHANNEL

58"x36" CMP ARCH SIPHON

CMP SIPHON

10 CURB OUTLETS FROM KING SOOPERS PARKING LOT

DRAINAGE AREA BOUNDARY

N

0 200 400 600 800

graphic scale

LEGEND

LINE WITH:	CURB INLET	MANHOLE	DROP INLET
EXISTING:			
PROPOSED:			
PHASE I			
" II			
" III			
" IV			
" V			
" IV			

STORM SEWER SYSTEM
PALMER PARK AREA

DESIGN PROPOSAL FOR THE CITY OF COLORADO SPRINGS

DESIGNED M.A.	KARCICH & WEBER, INC.
DRAWN W.B.T.	ENGINEERS PLANNERS CONSULTANTS
CHECKED	APPROVED
COLORADO SPRINGS	SCALE / JOB NUMBER / DRAWING NO.

ESTIMATED FLOW QUANTITIES

CASE II ALTERNATIVE II

DRAINAGE AREA BOUNDARY

DRAINAGE AREA BOUNDARY

CURB & GUTTER

AREA NOT RESTUDIED IN THIS REPORT

LAST PHASE

WASSON HIGH SCHOOL

JEFFERSON SCHOOL

EAST JUNIOR HIGH SCHOOL

58"x 36" CMP ARCH

(2) 42" STEEL

31" x 50" CMP ARCH

42" CMP

OPEN DITCH
OPEN CONC. "U" CHANNEL

W/GATE

RETENTION RESERVOIR

6'x3'-6" BOX CULVERT

2-58"x 36" CSP ARCH

63" x 98" ELLIPTICAL RCP

OPTIONAL CONC. BRIDGE

72" RCP

OPEN "U" DITCH

OPEN CONC. "U" CHANNEL

29"x 18" CMP ARCH

24" CMP

OPTIONAL REWORK EXIST. 2' INLET

48" CMP

OPEN CONC. "V" CHANNEL

REWORK EXIST. INLET

OPEN ASPHALT "U" CHANNEL

58"x 36" CMP ARCH SIPHON

CMP SIPHON

ABANDON EXISTING 72" CMP.

72" CMP

48"x76" ELLIPTICAL

34"x53" ELLIPTICAL

10 CURB OUTLETS FROM KING SOOPERS PARKING LOT

DRAINAGE AREA BOUNDARY

graphic scale 0 200 400 600 800

LEGEND

LINE WITH:	CURB INLET	MANHOLE	DROP INLET
EXISTING:			
PROPOSED:			
PHASE I			
" II			
" III			
" IV			
" V			
" IV			

STORM SEWER SYSTEM
PALMER PARK AREA

DESIGN PROPOSAL FOR THE CITY OF COLORADO SPRINGS

DESIGNED M.A.
DRAWN W.B.T.
CHECKED

KARCICH & WEBER, INC.
ENGINEERS PLANNERS CONSULTANTS
APPROVED

COLORADO SPRINGS

SCALE	JOB NUMBER	DRAWING NO.