City of Riverside

WASTEWATER COLLECTION AND TREATMENT FACILITIES INTEGRATED MASTER PLAN

VOLUME 4: WASTEWATER TREATMENT SYSTEM
CHAPTER 4: PLANT HYDRAULICS

FINAL
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City of Riverside

WASTEWATER COLLECTION AND TREATMENT FACILITIES INTEGRATED MASTER PLAN

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CHAPTER 4: PLANT HYDRAULICS

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PLANT HYDRAULICS

4.1 PURPOSE

The purpose of this chapter is to evaluate the ability of the Regional Water Quality Control Plant (RWQCP) to convey flows up to the peak wet weather flow (PWWF) through the facilities. The chapter also presents any bottlenecks that were identified during the analyses and any flow management strategies that could be used to address the problem areas.

4.2 CONCLUSIONS

- No hydraulic bottlenecks were identified during hydraulic model runs using existing facility average daily flow (ADF) treatment capacity (40 mgd) and existing ADF (33 mgd).
- Four hydraulic bottlenecks were identified for the PWWF. These bottlenecks include:
  - Plant 2 (24-inch) control valves/meters at the Headworks.
  - A 42-inch pipe connecting the Plant 2 primary clarifiers splitter box and the aeration basin influent splitter box.
  - Plant 1A/1B Distribution Channel.
  - A 54-inch pipe connecting Junction Box 13A and Junction Box 14.

These bottlenecks can be improved to an acceptable level with minimal additional piping and construction.

4.3 BACKGROUND

The RWQCP consists of two plants and currently receives inflow from six lines: the Arlanza trunk, the Riverside trunk, the Hillside trunk, the Acorn trunk, the Jurupa Community Services District (JCSD), and Rubidoux Community Services District (RCSD) force mains. The current design capacity of the RWQCP is 40 mgd, based on ADF. The headworks were redesigned in 1990 to convey a PWWF up to 100 mgd.

A hydraulic model was developed using the Carollo Engineers (Carollo) software, *Hydraulix*™, to simulate the hydraulics of the treatment plant. This model was developed based on existing plans. After the development of the hydraulic model, evaluations of the plant's hydraulics during existing flow, as well as for ADF and PWWF, were performed.

4.4 CURRENT PLANT FLOW RATE AND PEAKING FACTORS

Currently, the plant receives an inflow of approximately 33 mgd. Plant 1 treats 40 percent and Plant 2 treats the remaining 60 percent of the influent flow.

A Biotran model was developed for the RWQCP. Biotran models the steady state treatment capacity of the various process units. The Biotran estimated that the ADF capacity of the RWQCP is 40 mgd with a 50/50 split between Plant 1 and Plant 2. This is described more fully in Volume 4, Chapter 3 - Process Design and Reliability Criteria.

The wet weather peaking factor of 2.2, will be used to determine the RWQCP PWWF for most unit processes. The wet weather peaking factor for tertiary and disinfection processes is 1.5 because of the upstream equalization basins.

The equalization basins were sized to reduce the tertiary peaking factor to 1.5.

Table 4.1 summarizes the different flows that were used in the three hydraulic evaluations.

Table 4.1 Plant Flow Rates
Wastewater Collection and Treatment Facilities Integrated Master Plan
City of Riverside

Flow Condition	Plant Influent Flow (mgd)
Existing Plant Flow	33
Average Daily Flow	40
Hourly Peak Wet Weather Flow(1)	88

Notes:
(1) The treatment plant downstream of the equalization basins receives a PWWF of 60 mgd (1.5 peaking factor). Upstream of the equalization basins, the PWWF factor is 2.2.

4.5 ASSUMPTIONS

The following are the general assumptions that were used in development of the model and evaluations:

- The 50-year floodwater surface elevation, 690.30 feet for the Santa Ana River, was used.
- Flow through Plant 2 secondary clarifiers are proportional to the sizes of the clarifiers.
- Filter backwash plus filtrate flow averages about 3.5 mgd, based on existing plant flow.
- Plant 1 waste activated sludge (WAS) flow is approximately 0.15 mgd, based on existing plant flow. This was scaled proportionally for the other two flows.
- Plant 2 WAS flow is approximately 0.43 mgd, based on existing plant flow. This was scaled proportionally for the other two flows.
- Return activated sludge (RAS) flow is set at one times the ADF.
- According to the City staff, the recycle flow is split with a 20:80 ratio between Plant 1 and Plant 2.

- Currently, Chlorine Contact Basin No. 2 (CCB2) is out of service, secondary treatment goes through Chlorine Contact Basin No. 1 (CCB1) and Chlorine Contact Basin No. 3 (CCB3) only.

Table 4.2 lists the different operational settings used for the three hydraulic evaluations.

Table 4.2 Operational Assumptions
Wastewater Collection and Treatment Facilities Integrated Master Plan
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Operation	Current Flow	ADF	PWWF
Plant 1/Plant 2 Flow Distribution	40/60	50/50	50/50
Equalization Basins	Assuming only three are in operation		Assuming all four are in operation
Chlorine Contact Basin(1)	CCB3 treats up to 42.6 mgd. Flow above that level needs to be diverted to CCB2.		

Notes:
(1) CCB3 capacity was calculated based on a 90-minute contact time with a basin volume of 3.02 million gallons, and a Modal Contact Time/Detention Time ratio of 0.85.

One important note is that the hydraulic model is based on benchmarks that were used in the multiple sets of the existing facility plans. These benchmarks are about 0.22 feet above the benchmarks used in the 2003 RWQCP topographic map. For the hydraulic profile, it was decided to use the benchmarks from the existing facility plans to lessen the chance for error when referencing sets of plans that are based on the existing plan benchmarks. For elevations based on the new 2003 topographic benchmark elevations, subtract 0.22 feet from the elevations indicated on the hydraulic profile.

4.6 RESULTS

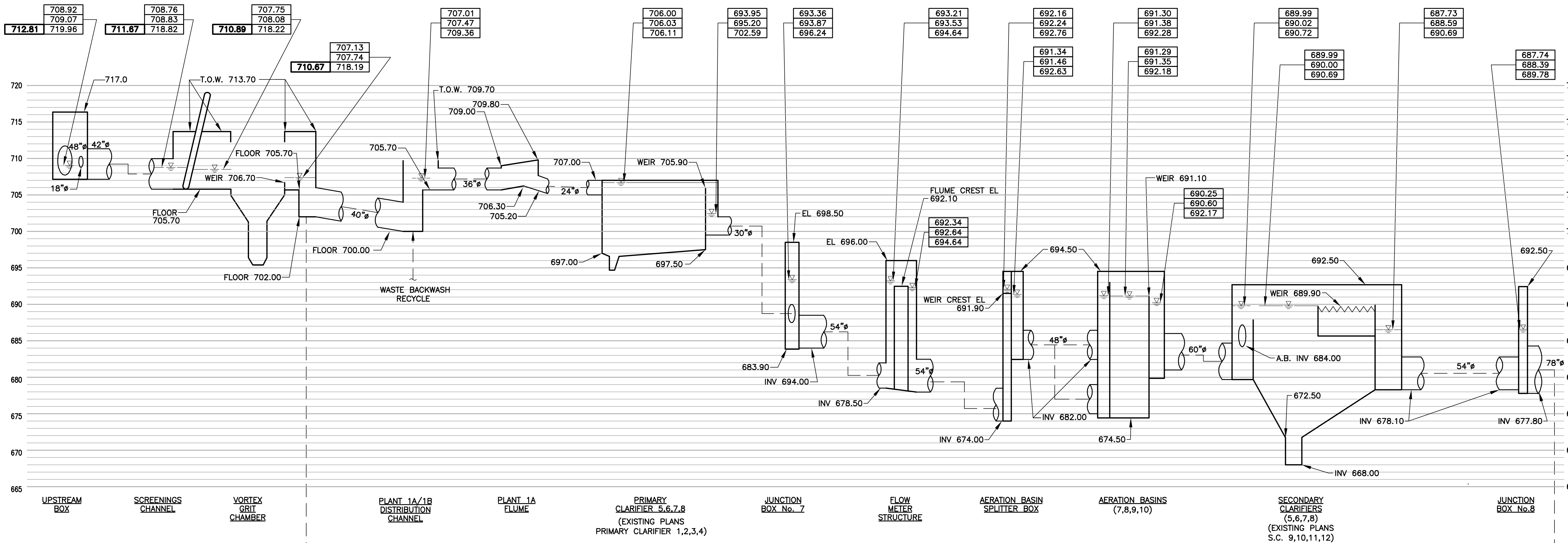
The purpose of the evaluations was to determine whether the plant could handle the different flow rates hydraulically. A freeboard criterion of 6 inches was used to determine any problem areas. A hydraulic profile of the plant is shown in Figure 4.1. It shows water surface elevations for all three hydraulic evaluations.

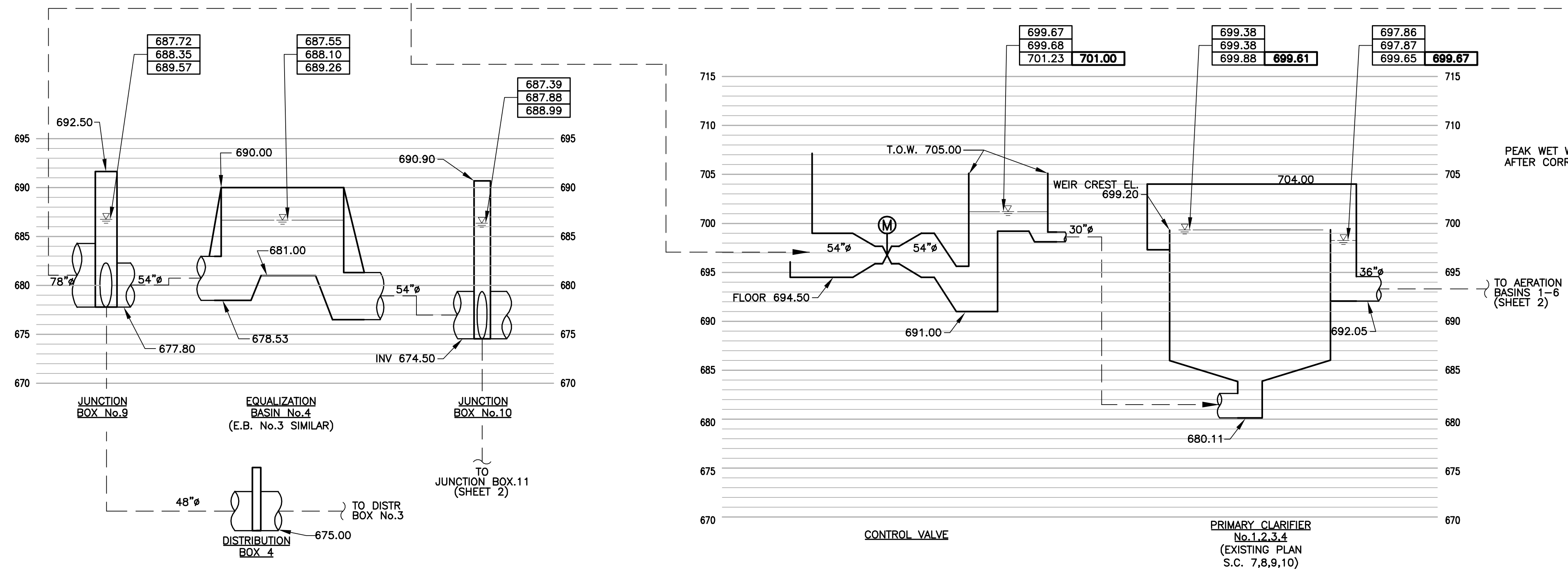
4.6.1 Existing Plant Flow

Based on the existing plant flow of 33 mgd, with a 40/60 flow-split between Plant 1 and Plant 2, and assuming three operational equalization basins and CCB2 is out of service, no bottlenecks were identified.

4.6.2 Average Daily Flow

Using the ADF capacity of 40 mgd, with a 50/50 split between Plant 1 and Plant 2, and assuming three operational equalization basins and CCB2 is out of service, no bottlenecks were identified.





LEGEND

XXX	EXISTING FLOW (33 mgd)
XXX	AVERAGE DAILY FLOW (40 mgd)
XXX	PEAK WET WEATHER FLOW (88mgd)

PEAK WET WEATHER FLOW (88 mgd) AFTER CORRECTION: **XXX** (BOLD)

NOTES

1. HYDRAULIC PROFILE IS BASED ON BENCH MARK ELEVATIONS FROM EXISTING PLAN, FOR ELEVATIONS BASED ON THE 2003 TOPO BENCHMARK ELEVATIONS, SUBTRACT 0.22 FEET FROM THE ELEVATIONS INDICATED ON THE HYDRAULIC PROFILE.
2. FOR EXISTING FLOW SCENARIO, A 40/60 FLOW SPLIT WAS USED FOR PLANT 1 & PLANT 2 A 50/50 FLOW SPLIT WAS APPLIED FOR ADF AND PWWF SCENARIOS.
3. IT WAS ASSUMED ONLY THREE EQUALIZATION PANELS ARE AVAILABLE FOR EXISTING FLOW AND ADF SCENARIOS (WORST CASE). ALL FOUR EQUALIZATION PONDS WERE ASSUMED TO BE IN SERVICE DURING PWWF.
4. ASSUMED CHLORINE CONTACT BASIN (CCB) 3 HAS A MAXIMUM CAPACITY OF 43.6mgd (BASED ON AN EFFECTIVE VOLUME OF 2.92 MILLION GALLON AND A 90 MINUTE CONTACT TIME). FLOW ABOVE THAT LEVEL NEEDS TO BE DIRECTED TO CCB 2.

HYDRAULIC PROFILE OF RWQCP

FIGURE 4.1 (SHEET 1)

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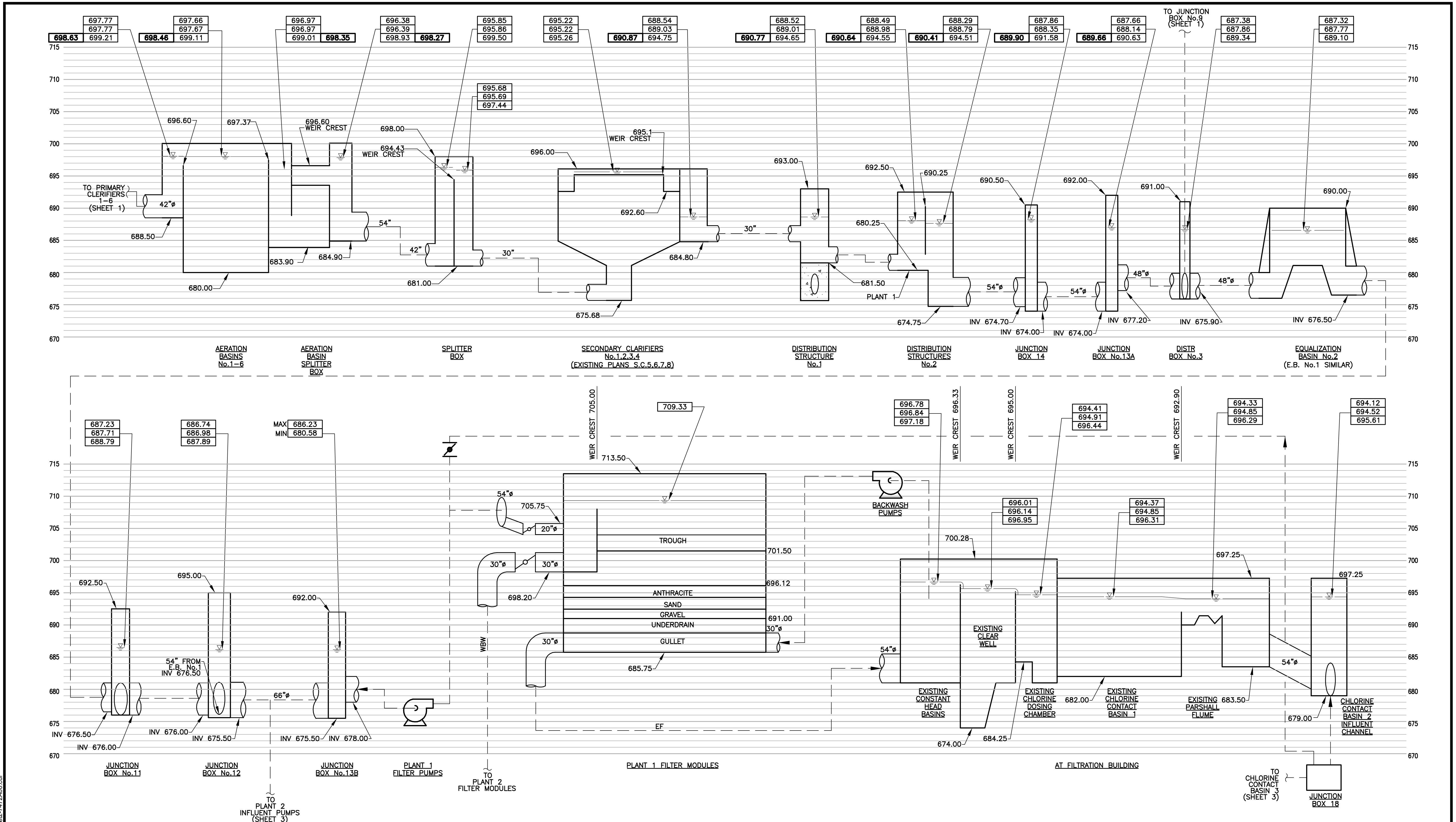

HYDRAULIC PROFILE OF RWQCP

FIGURE 4.1 (SHEET 2)

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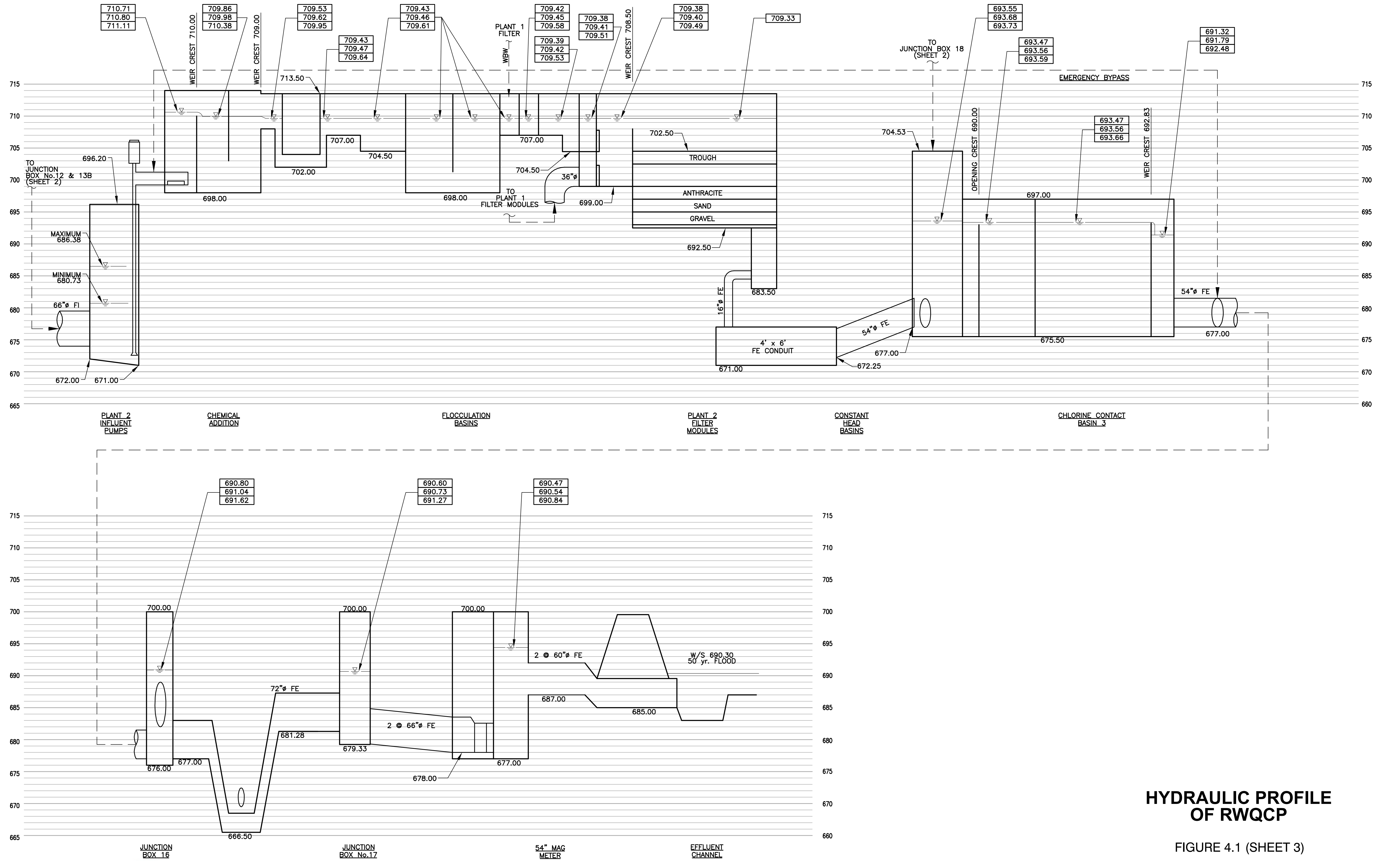

HYDRAULIC PROFILE OF RWQCP

FIGURE 4.1 (SHEET 3)

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4.6.3 Peak Wet Weather Flow

Using the PWWF, with a 50/50 split between Plant 1 and Plant 2, and assuming all four equalization basins and CCB2 are in service, four bottlenecks were identified:

1. Plant 2 (24-inch) control valves/meters at the Headworks.
2. A 42-inch pipe connecting the Plant 2 secondary clarifiers splitter box and aeration basin influent splitter box
3. Plant 1A/1B Distribution Channel.
4. A 54-inch pipe connecting Junction Box 13A and Junction Box 14.

4.7 FLOW MANAGEMENT STRATEGIES

As stated above, the first bottleneck occurs at the headworks. It is is caused by the two 24-inch control valves/meters. Currently, the influent flow to Plant 2 goes through these two flow control valves. The problem caused by these valves can be alleviated with minimal impact by installing a third 24-inch flow control valve. The existing piping has blind flanges to enable installation of a new valve.

The second bottleneck occurs between the Plant 2 secondary clarifiers splitter box and the aeration basin influent splitter box. At PWWF, this bottleneck causes the weir to be submerged at the aeration basin and the primary clarifiers. This problem can be fixed by up sizing this pipe from 42 inches diameter to 54 inches diameter.

The third bottleneck occurs at Plant1A/1B distribution channel. This bottleneck will be addressed during the 2008 Expansion project.

The last bottleneck occurs at the 54-inch pipeline connecting Junction Boxes 13A and 14. A review of the existing plan indicated there is not enough space for installation of additional pipes between Boxes 13A and 14. This bottleneck, however, can be resolved by installing a new 48-inch pipeline between Distribution Box 3 and Junction Box 13A and modifying the boxes. Existing plans show that there is enough space in the yard to install a 48-inch pipe next to the current 48-inch pipe and increase the size of boxes to accommodate the parallel pipeline.

The surface water elevations for the PWWF condition, after the corrections, are listed on the Hydraulic profile in Figure 4.1. The proposed flow management strategies have eliminated the bottlenecks.