Chapter – 4
Surveys and Investigations

4.1 General

The Polavaram - Vijayawada link canal takes off from the right flank of Polavaram multi-purpose project proposed by the Government of Andhra Pradesh. Since no separate head works are proposed under Polavaram - Vijayawada link canal project, no separate toposheet studies and field surveys have been carried out by NWDA related to the head works. The State Government has carried out extensive field surveys to determine the best suited alternative for the dam site and other related components (a detailed project report has already been prepared), various details of which are neither discussed nor appended here to contain the scope and volume of the present report.

At the toposheet study stage, a number of alternative alignments for the Polavaram - Vijayawada link canal have been considered, out of which the alignment adopted by the State Government for the Right Main Canal of the Polavaram project is found to be best suited and hence adopted for the Polavaram - Vijayawada link canal. As such, the proposed Polavaram - Vijayawada link canal follows the same alignment as that of the Polavaram Right Main Canal for which the field surveys were conducted by the State Government. However, the representative cross sectional surveys, site surveys and commands area surveys have been carried out by NWDA in specific reaches, which were not covered earlier. The relevant details of surveys conducted by NWDA as well as State Government are discussed here.

4.2 Topographical Surveys

4.2.1 Canal and Water Conductor System and Canal Structures (Field Surveys Conducted by Government of Andhra Pradesh)

Initially, the alignment of link canal was marked on the toposheets. With the help of the toposheets and corresponding village maps, approximate base lines corresponding to the canal alignment were set on the ground.

Cross sections at every 200 m on the base line were taken with levelling at an interval of 30 m or 50 m along the cross sections depending upon the topography. The cross sections were extended upto 3 m above full supply level of canal on higher contour side and 3 m below canal bund level on lower contour side, the aim being that the preliminary surveys conducted would afford ample scope to study various alternatives on the plan. Levels were also taken at intermediate valleys and ridges to obtain the true and correct topographical features of the country. The cross section levels were plotted on the village plans and contours at 1 m interval were drawn. All possible alignments were studied and the best suitable alignment of the canal was finalised considering all relevant technical and economical aspects. The final alignment was transferred to the ground with the help of village plans for carrying out further surveys. Then, the detailed final surveys were carried out by taking cross sections at 200 m intervals. Levels on the cross sections were taken at close intervals of 5 to 10 m extending up to a length of 200 m on either side of the alignment.

Since the main canal is a contour canal, it crosses a number of valleys. These valleys will be crossed by different types of cross drainage works like aqueducts, under tunnels, super passages, etc. For all roads and important cart track crossings, single lane and double lane bridges were proposed across the canal with a vertical clearance of 1.2 m above FSL of canal. Site surveys were conducted for all major structures and typical minor structures. Surveys for cross-drainage and cross masonry structures were conducted for preparation of cost curves for arriving at the cost estimates. The cost curves are prepared separately for each type of structure viz., aqueduct, under tunnel, super passage, double lane bridge and single lane bridge by estimating the costs of at least three numbers of structures in each type.

4.2.2 Field Surveys done by NWDA

With a view to check any changes in the topographical features, over the time since the last survey done by the Andhra Pradesh State project investigating authorities, NWDA selected a few problematic reaches to review/verify the earlier survey carried out by State Government. Re-survey work of typical canal cross sections was carried out in the reach from RD80 to 84 km, where heavy cutting and embankment was earlier proposed by Andhra Pradesh. Cross Sections were taken at every 50 m along the alignment and extended up to 200 m on either side for taking spot levels at 50 m intervals. It is observed that in the cutting reach between RD 80.0 and 81.8 km, there is no significant change between the earlier alignment and the alignment based on NWDA survey. In the filling reaches, however, by slightly altering the alignment, the height of embankment needed could be reduced by about 2.0 m. However, the length of canal as per the alteration proposed in this reach is slightly more as compared to that proposed by the Andhra Pradesh State and hence the saving by reduction in the embankment is likely to be marginalised by increase in length. As such, for the purpose of feasibility report, the earlier alignment as proposed by the State only is considered.

Block levelling was carried out at two locations, one at RD 70.6 km where double lane road bridge is proposed across the canal on the road connecting with Chebrolu and Gollagudem, and the other at RD 122.35 km where an aqueduct is proposed at the crossing of Ramileru river. The block levelling has been done at 50 m interval.

The last 12 km reach of the link canal follows the existing Budameru Diversion Channel. In order to verify the discharging capacity of Budameru Diversion Channel and to assess its capacity to carry the quantity of water to be diverted to Krishna through the link canal, the longitudinal section and some representative cross sections have been surveyed afresh. The longitudinal section up to RD 5.20 km with levels at 50 m interval and cross sections upto RD 4.80 km at 100 m interval on Budameru Diversion Channel were taken. The adequacy of Budameru Diversion Channel to carry the required discharge is checked and details are given in Chapter on Structure and Layout.

4.2.3 Command Area Survey (Sample)

A sample command area survey of the Polavaram - Vijayawada link canal under Chebrolu branch canal (in mixed red and black soil) has been carried out by NWDA. Block levelling in 50 m grid was completed to cover an area of about 1000 ha. The levels were plotted and contours with an interval of 0.5 m were drawn. The

alignment of entire distributary system comprising of major, minor, sub-minor and field channels is drawn on the block command plan, for preparing the cost estimates for distributary system. The estimates then, could be adopted for the entire command area under Polavaram - Vijayawada link canal. The entire command area has been surveyed by Survey of India earlier for Government of Andhra Pradesh and the maps to scale 1: 10000 have been prepared with a contour interval of 0.5 to 1.0 m.

4.2.4 Soil Conservation

As the topography in the region of the link canal is not so steep as to warrant any special soil conservation measures in the command area, no separate surveys for soil conservation were conducted.

4.3 Other Surveys

4.3.1 Archaeological Surveys

As the alignment of canal does not affect any places of archaeological importance, no archaeological surveys are contemplated.

4.3.2 Mineral Surveys

There are no mineral deposits that get affected either in the canal excavation or in the command area.

4.3.3 Communication Surveys

The command area under the link canal is well served by a network of existing roads, viz., State Highways, District Roads, Zilla Parishad Roads etc., connecting almost all the villages. The National Highway No. 5 as well as a broad gauge main line of South Central Railway connecting Vijayawada and Visakhapatnam, run through the command area. The State Highways and other District Roads are connected to NH - 5. Also, there are sufficient number of power transmission and telephone lines and some more are being laid as a part of development.

4.3.4 Drainage Surveys

The command area is well drained by rivers/major streams like Kovvada Kalva, Yerra Kalva, Gunderu, Tammileru, Ramileru and Cheemalavagu and also by a number of other major and minor drains. Since the general slope of the country is towards east (Bay of Bengal), no serious drainage problem is anticipated. However, as the command area develops, necessity to provide drainage facilities such as field drains and minor drains to connect to the natural drains and improving the existing ones may arise. Sample drainage survey will have to be taken up at a later stage of project development.

4.3.5 Soil Surveys

The detailed soil surveys of the command area have been done by A.P. Agricultural Department. The soils available in the command area are predominantly red soils, black cotton soils and deltaic alluvium. This aspect has been dealt in detail in **Chapter on Command Area Development and Drainage.**

4.4 Foundation Investigations

The detailed classification of various soils met with along the entire length of canal alignment has been done by the State Government by excavating open trial pits and auger holes at every 200 m interval. These are shown in the longitudinal section maps of the canal. In case of canal structures, bore holes data were collected and the samples tested for allowable stress limits.

4.5 Construction Material Investigations

Necessary quarry surveys have already been conducted by the State Government of Andhra Pradesh to assess the availability of construction materials and their quality. It is found that the required construction materials are abundantly available in and around the canal alignment .

4.5.1 Borrow Area Survey

Soils from canal excavation are proposed for formation of embankments. Where the earth from excavation is found to be inadequate, it is proposed to borrow the earth from the nearby fields. Based on broad soil classification in command area in the vicinity of the link canal and the bore hole data along the canal alignment, the soils could be classified as (i) soft black cotton soils, (ii) ordinary gravel, (iii) red earth, (iv) hard red earth (v) hard gravel which are considered to be suitable for construction of embankment in part filling and cutting reaches.

4.5.2 Sand

Coarse as well as fine sand conforming to required specifications are available in the nearby rivers/streams, viz., Godavari, Kovvada Kalva, Yerra Kalva, Tammileru, Krishna, etc., along the canal alignment within economical leads.

4.5.3 Rock and Aggregate

Stone for masonry and the coarse aggregate for concrete required for the construction of structures are available within economical leads from the quarries.

4.5.4 Bricks

Soil of suitable quality for manufacture of bricks and tiles is available for use in building construction along the canal alignment.

4.5.5 Cement and Steel

Cement manufactured by reputed companies in the vicinity (for e.g. at Vijayawada and Macherla) can be used. Cement and steel will be received at the nearest railway stations located in close proximity of the canal alignment (viz., Kovvur, Nidadavolu, Tadepalligudem, Eluru, Nuziveedu, Gannavaram, Vijayawada, etc.) and transported to the construction sites.

4.6 Hydrological and Meteorological Investigations

The Polavaram – Vijayawada link canal project is one of the components of the interlinking of Mahanadi – Godavari – Krishna – Pennar - Cauvery for inter-basin

transfer of water. Detailed hydrological analyses have been carried out by NWDA to arrive at the water balance in respect of the basins / sub-basins in this region. The water balance study reports have been separately brought out by the NWDA. All the hydrological and meteorological data available in various State and Central Organisations have been collected by NWDA for carrying out the water balance studies.

The Godavari basin (which is the donor basin for Polavaram - Vijayawada link) is the largest and one of the most important river basins in Peninsular India. The basin possesses an adequate network of rain gauge stations, IMD observatories and river gauging sites.